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A determination of the feasibility and desirability of a six-state Educational Television Network in the states of Iowa, Nebraska, Minnesota, North Dakota, South Dakota, and Wisconsin was conducted. It was found that a six-state, educational television network was possible from a technical viewpoint. The network would use only educational stations already on the air and additional VHF reserved channels already allocated to education by the FCC. It would serve almost three-quarters of the people within the six states. Educational television could provide teachers for subjects not being taught in rural and other schools unable to have qualified teachers in those subjects. It could bring cultural and vocational programs to areas far distant from their source.

The capital cost of establishing a network would be approximately $2,000,000. The operating costs, on the basis of a 25-hour week, would be approximately $500,000 per year, or an average of less than $100,000 per state.

An administrative plan would be devised to avoid legal objections to the use of the network's services by public or private schools, colleges or universities.

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UPPER MIDWEST SIX-STATE EDUCATIONAL TELEVISION NETWORK SURVEY

IOWA - MINNESOTA - NEBRASKA - NORTH DAKOTA - SOUTH DAKOTA - WISCONSIN

INSTRUCTIONAL TECHNOLOGY - U.S.C.

Prepared by the Twin City Area Educational Television Corporation for the National Association of Educational Broadcasters under the terms of a grant from the Louis W. and Maud Hill Family Foundation

U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
Office of Education

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A SURVEY
# of the
ADMINISTRATIVE, ENGINEERING AND PROGRAMMING FEASIBILITY
# of a
SIX-STATE EDUCATIONAL TELEVISION NETWORK

Under A Grant From

The Louis W. and Maud Hill Family Foundation

to the

National Association of Educational Broadcasters

Survey Conducted By

Twin City Area Educational Television Corporation

KTCA-TV

St. Paul, Minnesota

John C. Schwarzwalder, Ed.D., Project Director
Paul H. Owen, Program Consultant
W. D. Donaldson, Program Consultant
Berten A. Holmberg, Engineering Consultant
John H. Klindworth, Engineering Consultant

March 31, 1960

ED002424

FOREWORD

The development of Educational Television from its first station only seven years ago to the present fifty stations, with numerous supporting institutions, has not been the product of either caprice or accident. This growth and development has taken place largely because of tremendous educational needs which only Educational Television can fill both well and economically. These needs, of course, are the twin necessities of providing an ever-higher quality of education to an ever-increasing number of students. Only Educational Television among modern educational tools has demonstrated an ability to cope successfully with both the qualitative and the quantitative needs of education of and for our times.

For this reason it is entirely logical that, in literally dozens of areas, educational television leaders are now beginning to plan in terms of state and regional networks. For, if one station can bring the highest quality of education to hundreds of thousands, a network can bring the same superb quality of education to millions.

With this in mind, the National Association of Educational Broadcasters, under the terms of a generous Grant from the Louis W. and Maud Hill Family Foundation, directed me to pursue this survey to determine the feasibility and desirability of a six-state Educational Television Network in the states of Iowa, Nebraska, Minnesota, North Dakota, South Dakota and Wisconsin. The present report is the result of that survey.

Acknowledgements should be made, if space permitted, to literally hundreds of persons who assisted in the completion of the survey. Acknowledgement must be made, however, to a most able group of consultants who travelled long distances in order to subject early drafts of this study to their searching and penetrating analyses. Such mistakes as may remain in the report are not their responsibility, but there would have been many more such errors but for their aid. These consultants were:

Dr. Samuel L. Becker, Director, Division of Television, Radio, Film, The State University of Iowa. Chairman of Research Committee of the National Association of Educational Broadcasters.

Dr. Richard I. Evans, Professor of Psychology, University of Houston. Member of Research Committee of the National Association of Educational Broadcasters. Research investigator and consultant for various psychological and biological science projects in Educational Television.

Richard B. Hull, Director of Radio and Television (WOSU-AM-FM-TV), Ohio State University. Member of: National Educational Television and Radio Center Board of Trustees; Committee on New Media, National Defense Education Act; Sub-Committee on Television, North Central Association; President, Ohio Council on Educational Television; Vice Chairman, Ohio Governor's Commission on Educational Television Study.

Jack G. McBride - Director of Television and General Manager of KUON-TV, University of Nebraska; Chairman of Television Planning Committee, National Association of Educational Broadcasters; Educational Broadcasting Consultant.

Martin J. McGowan, Jr. - Publisher of The Appleton Press; Representative in Minnesota State Legislature; Member of Board of Directors of Friends of Educational Television; Board Member of proposed Channel 10 (Educational Television station) at Appleton, Minnesota.

Carl H. Menzer - Director of Radio Stations WSUI & KSUI; Professor of Electrical Engineering, State University of Iowa; Chairman of Engineering Committee, National Association of Educational Broadcasters.

Dr. Harry J. Skornia - President, National Association of Educational Broadcasters; Chairman, Mass Communications Committee, U. S. National Commission for UNESCO. Author of numerous articles. Member, numerous Professional Associations and Committees.

Ralph Steetle - Executive Director of the Joint Council on Educational Television. Since 1951 this Council has been directed by Mr. Steetle and has provided legal, engineering, public relations and planning assistance to every proposed or operating Educational Television station in the United States.

Finally, an especial acknowledgement must be made of the constant aid given to the Project Director and his colleagues by Mr. A. A. Heckman, Executive Director of the Louis W. and Maud Hill Family Foundation. Mr. Heckman's wide experience with surveys and reports concerned with many different aspects of education makes his counsel and advice a most valuable resource for any worker in any part of the educational field. It proved to be such a resource many times over for my associates and for me.

John C. Schwarzwalder
Project Director

March 31, 1960
St. Paul, Minnesota

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THE NETWORK PLAN

SIX-STATE EDUCATIONAL TELEVISION NETWORK

IN THE NAEB UPPER MIDWEST AREA

NATIONAL ASSOCIATION OF EDUCATIONAL BROADCASTERS

NAEB

OFFICE OF THE PRESIDENT

14 Gregory Hall
Urbana, Illinois

Dear Dr. Dunham:

During the past few months, thanks to a grant from the Louis W. and Maud Hill Family Foundation, a study of possibilities for interconnected live regional networks for educational television has been carried out. Directors and consultants for the study, under the supervision of Dr. John C. Schwarzwalder, were all uniquely qualified, and the report itself was reviewed, before it was finalized, by a group of distinguished educators and broadcasters.

Because we feel that this study is one of the most significant ones in recent years, affecting education for the future, we take pleasure in calling it to your attention, and that of your staff.

We commend to your attention particularly the first two sections of the report: Foreword and Part I: The Network Plan, which present most of its implications in summary form.

We hope this study may be of value and interest to you.

Sincerely yours,

Harry J. Skornia

Harry J. Skornia
President

HJS:jp

Introduction

Under terms of a Grant by the Louis W. and Maud Hill Family Foundation to the National Association of Educational Broadcasters, KTCA-TV was directed to prepare a Network Plan for a six-state educational television network if, indeed, such a network should be determined both feasible and desirable. This directive was given and the grant made after considerable preliminary discussion on the subject had culminated in a resolution by Region IV of the National Association of Educational Broadcasters. This resolution requested action by the Regional Director toward implementing a comprehensive study of the feasibility of such a six-state educational network. The Grant to the National Association of Educational Broadcasters by the Louis W. and Maud Hill Family Foundation made this requested study possible.

It will be noted that the Network Plan, as presented here, is actually a compilation and abridgement of three different sections which follow it in the complete report, namely, the Administrative Plan, the Program Study and the Engineering Survey. These three sections contain all the necessary documentation for statements made in the Network Plan, as well as the necessary technical and statistical information which would be required to establish a Network.

Under the terms of the Grant, distribution of the report will be made to each legislator, state officer, and major educational administrator in each of the six states, as well as to other prominent community leaders. Their comments, questions and criticisms are invited and desired.

General Considerations

After exhaustive study and investigation, it can now be fairly and definitely stated that a six-state, interconnected (micro-wave), educational television network is entirely possible from an engineering or technical point of view. Such a network, using only educational stations now on the air and additional VHF reserved channels already allocated to education by the FCC, would serve almost 10,000,000 people — or almost three-quarters of the people within the six states. Additional allocations and the use of UHF channels could raise this tremendous total to an even higher figure.

Such a network is considered highly desirable by thousands of citizens of the area, including business men, educators, labor, professional and community leaders. It is obvious the network would encourage the establishment of more Educational Television stations and enable those on the air to broadcast more, (and higher quality), programs at little or no extra cost. The educational advantages of this are obvious.

The capital cost of establishing such a network would be approximately $2,000,000. Divided among six states, this would entail an average expenditure less than that required by the average elementary school in most states.

The operating costs for such a network (twenty-five hours per week) would be approximately $500,000 per year, or an average of less than $100,000 per state. It should be noted that these costs are conservatively estimated and that savings in both capital and operating costs are entirely possible.

Finally, it can be stated that a plan for administering the network, which has met with the unanimous approval of directly-concerned persons in all six states, has been devised and that this plan obviates legal objections to the use of the network's services by public or private schools, colleges or universities.

Engineering

The Engineering Plan envisages a double system, micro-wave relay connecting present or potential VHF stations at Lincoln, Nebraska; Ames, Des Moines and Iowa City, Iowa; Milwaukee and Madison, Wisconsin; the Twin Cities and Appleton, Minnesota; Freeman (Sioux Falls), South Dakota; and so back to Lincoln. From this line one branch would go to Duluth-Superior and another, by way of Fargo, to Grand Forks, North Dakota. From Lincoln a secondary (one-way) system for Western Nebraska is provided at additional cost. From Freeman and Fargo Western South Dakota and Western North Dakota may respectively be served. It is contemplated that each station on the primary network could both receive and transmit programs, and that each would have a video tape recorder which would enable it to store programs for local release at the most opportune time.

Such a system would be many times less expensive than one served by common carrier cable, and much less expensive than one served by video tape only (necessitating a large tape inventory).

The technical quality to be expected from such a network would be, if not equal to live transmission, at least equal to a medium grade kinescope recording such as are frequently used on numerous television stations. Moreover, technological advances in the future may well serve to improve this highly usable quality even further. Such technical advances might, in the future, make color transmission possible over the network though this is not now practical.

It should also be noted that the network, as contemplated, would provide a valuable communication system for its affiliates (and those who supply their programs) and, during certain hours (and all emergencies) could be made available for regional communications by agencies such as Civil Defense, and Highway and Police Departments in the states that cared to make use of the system.

Programming

Such a network could bring its programs to about 10,000,000 persons or about 74% of all the people in the six states. It would provide a first-class teacher of science to every child in every elementary school within reach of its signals (and this would be more than three out of every four children in the area). It could teach Spanish to thirty thousand children in rural schools and physics to a thousand high schools unable to have qualified teachers of those subjects. It could bring the best knowledge of agriculture available in six great state colleges of agriculture to thousands who could profit from such instruction. It could bring music by great artists to the old and the heritage of our country, as explained by the great men and women among us, to the young. And only an educational television network can do all this at a price we can afford.

Costs

The cost structure of the network is detailed below. Let it be said first, however, that the costs of a network program must be divided by the number served which tends to render the unit cost infinitesimal. For example, a teacher at $3.00 per hour who teaches 30 children in a classroom for an hour would mean a unit cost of 10¢ per hour per child. The same teacher, teaching 30,000 children by an educational television network means a unit cost of $\frac{1}{100}$ of a cent. Unit cost fades almost into insignificance when it is realized that nearly two million two hundred thousand school children would be within range of network stations. If to this is added the fact that only by television is it possible, at times, to provide a teacher of chemistry or German or algebra to thousands of children, the economic necessity of an educational television network becomes clear.

Costs (capital) for establishing the network will be about $2,000,000. Approximate costs by state (less at least a 10% educational discount) will be as follows:

Iowa	$ 501,070.
Minnesota	781,163.
Nebraska	191,596.
North Dakota	139,958.
South Dakota	228,455.
Wisconsin	346,333.
	$ 2,188,575.

The division of costs between the states has been adjusted according to the number of miles the network runs in each state.

The operating costs for the network will aggregate something over $500,000 annually. The division among the states would be as follows: (using a formula similar to that used in dividing capital costs).

Iowa	$ 119,587.
Minnesota	184,796.
Nebraska	48,960.
North Dakota	36,356.
South Dakota	57,606.
Wisconsin	84,273.
Total	$ 531,578.

These costs are based on a twenty-five hour network week. They may go up or down in proportion to hours added or subtracted. Some commercial television stations have offered support for the network in return for the right to re-use its material. Such an arrangement, if desired by many such stations, might reduce costs to a very small figure indeed.

Administration

The network would be a non-profit corporation supplying a service, educational telecasts, to educational institutions. As such, its services could be readily obtained by any educational institution whose directing board desired such services.

The non-profit corporation would be governed by a Board of Trustees composed of one representative from each affiliated Educational Television station or Production Center. It is hoped that members of State Boards of Regents, University Presidents, prominent civic leaders and professional men would be willing to serve on this policy making Board. An Operations Board, composed of station and production center managers or program directors, would determine, within the policies set by the Board of Trustees, the program operation of the network. Under the direction of this Board an Executive Director and such other employees as are needed, including engineers, would operate the network.

No station would receive compensation for programs it provided the network. No station, under any circumstances, could ever be forced to use any program it did not wish to use.

Conclusion

Television channels, both for broadcast and micro-wave purposes, are a rapidly vanishing national asset. The channels to build a six-state network for education are available today. It would be a rash man indeed who would predict these channels would still be available five years from today.

The establishment of a regional network in this area is practicable, economical and extremely desirable now. In, say, 1966 it may still be extremely desirable. Indeed, with rising school population and the ever-increasing shortage of qualified teachers it may be even more desirable then than now. But if channels are not reserved, stations activated and networks established, these channels may no longer be available. In which case, no amount of either tears or money will serve to repair the damage or retrieve the loss. Obviously, those of us deeply committed to providing the best of educational opportunity, not only for our children but for our posterity, must be concerned with the activation of a regional educational television network now.

John C. Schwarzwalder

John C. Schwarzwalder
Project Director

ADMINISTRATIVE PLAN

SIX-STATE EDUCATIONAL TELEVISION NETWORK

IN THE NAEB UPPER MIDWEST AREA

I INTRODUCTION

II ORGANIZATIONAL POSSIBILITIES

III THE ADMINISTRATIVE PLAN

IV OPERATING COSTS

V ACCEPTANCE OF ADMINISTRATIVE PLAN

VI APPENDIX

PART I

INTRODUCTION

In any plan involving the administration of a non-profit network connecting non-profit educational television stations which are, or would be, owned and operated by such diverse bodies as state universities, school boards, boards of vocational education, private non-profit corporations, private schools and colleges, and perhaps yet other entities, it becomes necessary to accept several principles as a guide to procedure.

The first of these principles is, as the engineers assure us, the necessity of unified direction of technical matters, specifically those having to do with transmission standards and proper maintenance. The second is the obvious necessity for local control and determination of the programs to be aired by their respective local stations. The third is the necessity for all those involved in administering the stations affiliated with such a network to have a voice in any decisions as to what programs are to be transmitted over the network and when such transmission shall take place. The fourth and final principle is that the network must be operated as economically as possible consistent with clear transmission and adequate service to its affiliated stations and the audience such stations serve.

To express this in another way, the network must be technically excellent and economically maintained which means centralized technical and engineering supervision. However, it must be governed by the local Educational Television stations using the network and programs sent over the network must be only those wanted by the local Educational Television stations.

Most important, the right of the local Educational Television station to use or refuse any or all network programs is the most essential principle of all.

PART II

ORGANIZATIONAL POSSIBILITIES

Following these principles, several possibilities for organization were considered. First, a compact among the several states of the region which would be ratified by the state legislatures was considered. A similar pattern was proposed in connection with the projected Southern Regional Educational Board Educational Television Project for a sixteen-state network. This organizational possibility was rejected because, first, too many actual and potential Educational Television stations in this six-state region had no relationship to the state government: second, it was feared such an arrangement would take many years to effectuate and would be too cumbersome in operation. Finally, it was felt that such an organization would not be sufficiently responsive to the needs of non-governmental educational organizations.

A second way of effecting a network service would be in the nature of an informal agreement to exchange programs among the various participating stations. However practicable such an arrangement might be between two, or even three stations, it obviously would break down if the interests and needs of a dozen stations, three dozen production centers and several score communities were to be considered.

It therefore became apparent very early in the investigation of this matter that a flexible plan, safeguarding local autonomy, but providing the necessary unity for technical, financial, and circulation purposes must be devised.

In the course of finding such a plan, no less than fifty-eight persons were consulted. Each state in the six-state region was represented in this group which was comprised of educational leaders, state officials, community leaders, technical personnel, business and labor leaders, religious leaders and legal experts. A partial list of these consultants forms an Appendix to this plan. All of these consultants, without exception, approved the principles embodied in the following plan.

PART III

THE ADMINISTRATIVE PLAN

The plan envisages a non-profit corporation to be known as the Upper Midwest Educational Television Network Inc., incorporated under the laws of any one of the six states (all of which have ample legal provisions for such a non-profit corporation).

The governing body of the Upper Midwest Educational Television Corporation would be a Board of Trustees consisting of one representative from each Educational Television station affiliated with the network and from each production Center contributing more than one hour of programming per month to the Network. Members of this Board of Trustees would receive no salaries or other compensation. It would be their duty to determine policy for the network. They would ordinarily meet not oftener than once each quarter of the year but they should have all necessary powers to govern the corporation. It would be hoped that such high-level administrators as presidents of universities operating Educational Television stations, chairmen of State Boards of Regents, Superintendents of major school districts, business leaders and Chairmen of Boards of Education would sit on this Network Board of Trustees. Each affiliate would, of course, select its own member of the Board. The Board would elect its own appropriate officers.

Responsible to this Board of Trustees would be an Operations Board composed of one member from each Educational Television station and production center. Ordinarily the members of this Board, also uncompensated, would be the Managers or the Program Directors of the stations and production centers. It would be their function to determine, within the broad policy limits set by the Board of Trustees, the operating schedule of the network. They would determine, (with advice from educational leaders and particularly after consultation with curriculum specialists), at what hour a course in Spanish at the fourth grade level, for example, would be sent out over the network and from which affiliated station this series would be broadcast. They would also be in charge of the salaried network personnel.

The personnel actually employed by this Network would fall into two groups, Administrative and Engineering. The Administrative personnel should be limited, at least at the outset, to an Executive Secretary, a Traffic Director and necessary secretarial help. The duties of such personnel should be confined to putting into effect the decisions of the Board of Trustees and the Operations Board. The Executive Secretary, who would represent the network to the public and to educational institutions, should be a man of considerable stature. It might be possible to obtain for this position a man, recently retired from a responsible business or educational post who could bring to the network his personal prestige as well as great ability. The Engineering personnel should consist of a Chief Engineer and such engineering assistance as he may require. The number of such assistants may be, as recommended by engineering consultants, twelve additional engineers. It may, however, be desirable to subcontract much of the maintenance services required to individual stations or to individual contractors. Obviously the principal duty of the Engineering staff would be to maintain the highest possible standards of Transmission with especial attention to equipment maintenance.

It being a cardinal principle of the organization of the Network that no station or state shall profit at the expense of others, no charge shall be made by any station for furnishing a program to the Network. Neither shall refusal of any or all programs be the basis for any charges or rebates. All engineering charges for the network operation should be assessed against the using organizations in accordance with the mileage covered by the network in each state. All charges for within-state network costs would logically follow the same formula when two or more stations within a single state use the network.

It should perhaps be emphasized here that this non-profit network would, in effect, furnish an educational service. Almost all school boards, all state colleges and universities, and all private colleges and schools in each one of the six states are fully empowered to purchase an educational service which in the opinion of its governing body (School Board, Board of Regents, etc.) would be of value to the pupils of such an educational institution. In other words, from a legal point of view, the purchase of an educational service from the network is not different from the purchase or rental of educational films or books from an organization supplying such material. Moreover, the question of the location of the organization supplying such material does not arise. School boards in Wisconsin and South Dakota can, and do, purchase educational films and books from corporations in New York and Illinois without legal hindrance. The same would apply to the network charges for such services.

PART IV

OPERATING COSTS

The Annual Administrative costs of the Network could be expected to be as follows:

Salaries

Executive Secretary	$ 8,500	
Traffic Director	6,000	
Secretary	3,300	
Part-time Stenographer	1,800	
		$ 19,600
Office Rent & Utilities	2,400	
Supplies, Telephone, Telegraph, Postage	800	
Social Security, other taxes and incidentals	700	
Travel Expenses for Board Meetings	6,500	
		10,400
	Total	$ 30,000

The Engineering costs as presented by our consultants were as follows:

Annual Operating Costs	282,720
Depreciation of Equipment	210,858
	$ 523,578

The total Network costs by State would be about as follows:

Iowa: $114,587 + $5,000 per annum* or	119,587
Minnesota: $179,796 + $5,000 per annum or	184,796
Nebraska: $43,960 + $5,000 per annum or	48,960
North Dakota: $31,356 + $5,000 per annum or	36,356
South Dakota: $52,606 + $5,000 per annum or	57,606
Wisconsin: $79,273 + $5,000 per annum or	84,273
Total	$ 531,578

*($5,000 per annum or 1/6 of $30,000)

Methods of meeting these costs within each state might vary. The simplest and perhaps most efficient method might be by direct legislative appropriation to an appropriate state agency (State Board of Education, State Educational Television Commission, etc.) for this purpose. It is possible, however, that some sort of division of cost between the "using agencies" (school districts, colleges, etc.) might be preferred in certain states. This might complicate payment to the network considerably but it was believed by our consultants that this could be worked out on a contractual basis without serious difficulty. It should be noted also that inclusion of the secondary networks would greatly increase operating costs for the states of North Dakota, South Dakota and Nebraska.

Further economic notes may be in order. If each station now operating gave as little as five hours per week of its programming to the network some twenty-five hours per week would be available to each new Educational Television station coming on the air. If a new station operating twenty-five local hours per week spends $100,000 per year it could double its program schedule (and therefore its service to the people of its area) for less than $2,000 per year in extra power cost. There are very few areas in education or in business where a 100% gain in service can be financed by a two percent rise in costs. The financial efficiency of a network, which applies to educational as much as to commercial television, is, therefore, almost as important a factor to be considered by educators and legislators as is its educational efficiency.

At least one commercially operated station in the six-state area has indicated its desire to obtain, for release on a delayed basis, the programs sent over the network. It stated that it would be willing to compensate the network in the amount of $15,000 per annum for this privilege. It is obvious that if even ten commercial stations within the six states were minded to take a similar action network costs could be reduced substantially. If thirty were to take such action (or only an average of five per state), almost the entire network costs would be underwritten.

PART V

ACCEPTANCE OF ADMINISTRATIVE PLAN

The proposed administrative and cost structure which has been detailed above has met with general approval. The plan has been presented to many persons in all six states. It has met with no serious objections and has been welcomed with warmth in every locality where this network service could be received. Appendix I is a partial list of those who were informed of the plan during its developmental period and whose comments and criticisms found a place in the completed plan. Appendix II is an excerpt from the official minutes of the Iowa Joint Committee on Educational Television which contains a resolution endorsing the plan. It should be noted that similar, if less official, endorsement has been received in each of the six states, though only Iowa, at this time, maintains an official statewide Commission devoted to Educational Television.

PART VI

APPENDIX

APPENDIX I

IOWA

AMES

Robert Mulhall, General Manager, WOI-TV, Iowa State University
James Davis, Asst. Manager, WOI-TV, Iowa State University
Richard Vogl, Manager, WOI-AM-FM, Iowa State University
Keith Ketcham, Chief Engineer, WOI-TV, Iowa State University
George R. Town, Dean, College of Engineering, Iowa State University

CEDAR FALLS

Daryl Pendergraft, Assistant to President, Iowa State Teachers College
Herb Hake, Director, Radio-TV Department, Iowa State Teachers College

DES MOINES

Forrest J. Moore, Iowa State Department of Public Instruction
Paul F. Johnston, Iowa State Department of Public Instruction
Walter T. Edgen, Iowa State Department of Public Instruction
Mrs. Joseph Rosenfield, Iowa State Board of Regents
David A. Dancer, Iowa State Board of Regents
Clifton Schropp, Manager, KDPS-TV, and Director of Audio-Visual Services, Des Moines Public Schools
C. Fred Kelly, Director of Instructional Television, KDPS-TV
Ralph P. Joy, Program Manager, KDPS-TV
Howard Andreason, Chief Engineer, KDPS-TV

IOWA CITY

Sam Becker, Director, TV-Radio-Film Department, State University of Iowa
John Winnie, Associate Professor, TV-Radio-Film Department, State University of Iowa
Carl Menzer, Manager, WSUI-KSUI, Professor of Electrical Engineering, State University of Iowa
Harvey H. Davis, Provost, State University of Iowa

MINNESOTA

APPLETON

Martin J. McGowan, Publisher, Appleton Press, and State Representative
James R. Bennett, Attorney at Law, President, West Central Minnesota ETV Corporation
Orville L. Pring, Mayor, Manager of Federal Land Bank Office, Trustee, West Central Minnesota ETV Corporation
Ralph G. Schmidt, Vice President, Farmers and Merchants State Bank, Trustee, West Central Minnesota ETV Corporation
Dr. J. A. Rorem, Physician and Surgeon, Trustee, West Central Minnesota ETV Corporation
W. R. Sandberg, Superintendent of Schools, Trustee, West Central Minnesota ETV Corporation
Dr. Robert P. Miller, Dentist, Commanding General, Minnesota National Guard, Trustee, West Central Minnesota ETV Corporation

DULUTH

George Beck, President, Twin Ports Area Educational Television Corporation

NEBRASKA

LINCOLN

Jack McBride, Manager, KUON-TV, University of Nebraska
Robert Schlater, Program Manager, KUON-TV, University of Nebraska

OMAHA

Don Emory, Dean, University of Omaha
Paul Borge, Head, Radio-TV-Speech Department, University of Omaha
Rev. R. C. Williams, Chairman, Division of Communications, Creighton University
G. Benjamin Paxton, Assistant to Chairman, Division of Communications, Creighton University
Miss Laura Jones, Chairman of Radio-Television Council of Omaha Professor of Communications, Creighton University

NORTH DAKOTA

FARGO

Robert Crom, Director of Communications, North Dakota Agricultural College
Don Schwartz, Assistant in Office of Communications, North Dakota Agricultural College

Dave Bateman, Radio-TV Specialist in Agricultural Extension, North Dakota Agricultural College
Dr. Theodore Donat, Physician, Chairman, Citizens Commission for Educational Television

GRAND FORKS

Myron Curry, Director, KFJM, University of North Dakota
John Penn, Chairman, Speech Department, University of North Dakota
Bernhard Gustafson, Director of Extension and Chairman of Radio-TV Committee, University of North Dakota
Scott Bryce, Assistant Director, KFJM, University of North Dakota

SOUTH DAKOTA

BROOKINGS

Alphus Christiansen, Assistant to President, South Dakota Agricultural College

SIOUX FALLS

R. H. Stavig, President, Augustana College
Rev. Roland Schwandt, Director of Development, Augustana College
James Kilian, Director of Public Relations, Augustana College

VERMILLION

James Slack, Manager, KUSD, University of South Dakota
Ken Rascke, Assistant to President, University of South Dakota

WISCONSIN

MADISON

Harold McCarty, Executive Director, WHA-TV, University of Wisconsin, and Wisconsin Radio Council
William G. Harley, Program Director, WHA-TV, University of Wisconsin
John Stiehl, Chief Engineer, WHA-TV-AM, University of Wisconsin

MILWAUKEE

Paul Taff, Manager, WMVS-TV, Board of Vocational Education

APPENDIX II

Excerpt from Minutes of The Iowa Joint Committee on Educational Television

A meeting of the Iowa Joint Committee on Educational Television, was held in the conference room of the State Board of Regents, State Office Building, Des Moines, Iowa, December 16, 1959.

Present:

STATE DEPARTMENT OF PUBLIC INSTRUCTION
Mr. Forrest J. Moore
Mr. Paul F. Johnston
Mr. Walter T. Edgen

STATE BOARD OF REGENTS
Mrs. Joseph Rosenfield
Mr. David A. Dancer

IOWA STATE TEACHERS COLLEGE
Mr. Daryl Pendergraft

STATE UNIVERSITY OF IOWA
Mr. Harvey H. Davis
Mr. Carl H. Menzer
Mr. John Winnie
Mr. Sam Becker

IOWA STATE UNIVERSITY
Mr. James H. Davis
Mr. George R. Town

DES MOINES BOARD OF EDUCATION
Mr. Clifton F. Schropp

Six-State Educational Television Network

At the request of the committee, Mr. John Schwarzwalder, Manager of the Minneapolis-St. Paul, Minnesota, Educational Television Station, appeared before the Committee and explained a study on the feasibility of a six-state educational television network, financed by the Hill Foundation, which he was conducting.

After listening to Mr. Schwarzwalder and discussing some questions about the plans for the proposed network, Mr. Becker introduced the following resolution:

> "Because of our interest in someday bringing the benefits of an educational television service to the entire State of Iowa, and because we feel that the plan presented by Dr. Schwarzwalder is a practical first step toward this state-wide service, we, the Iowa Joint Committee on Educational Television, wish to support the general idea of a six-state educational television network. We believe this plan to be practical both for the fiscal economies it promises and for the quality of service which it helps to insure."

Mr. Becker then moved the adoption of the resolution. Seconded by Mr. Jim Davis and carried.

A STUDY OF
EDUCATIONAL TELEVISION PROGRAM RESOURCES
IN THE NAEB UPPER MIDWEST AREA

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II. METHODS

III. EDUCATIONAL TELEVISION PROGRAM EXPERIENCE IN THE UPPER MIDWEST AREA

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- B. Sources of ETV Programs
- C. Types of ETV Programs

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IX. APPENDIX

PART I

FOREWORD

Fitting preface to a report on the Educational Television Program Resources in the NAEB Upper Midwest Area is the recognition of the region as one of the principal pioneering areas in the initial experiments and regular use of television for educational purposes. Much of this experimentation was inaugurated prior to the historic Federal Communications Commission decision in 1952 which created the assignment of certain television channels in the United States for Educational, Non-Commercial use.

As early as 1949 Creighton University in Omaha, using the facilities of that city's first commercial television stations, began regular presentation of systematic instruction materials. Later the Municipal University of Omaha undertook similar ventures in that city and both continue to make their resources available to the community via television.

In Iowa, WOI-TV began operation in February, 1950, as the nation's first educationally-owned television station long before creation of educational, non-commercial channels. It immediately became a nationally-recognized testing ground for the use of television for educational purposes in a wide range of utilization, and particularly through Agricultural and Home Economics extension work on television provided a valuable guide for those who were to follow.

Meanwhile, school systems and institutions of higher learning in other states of the region were awakening to the possibility of putting television to use in education. Experimentation and application were carried on in many centers, not only for purposes of service to the students in schools and colleges but also to employ their educational resources to the benefit of the general public.

In the relatively few years since these early efforts began, 50 non-commercial educational stations have been established in the United States, serving a potential audience of 70 million people. Five of these stations are now operating within the six-state area, serving over 5 million people who live within range of their signals.

Tens of thousands of diverse Educational Television programs have been developed nationally, a large percentage of them having been produced within the states under consideration of this study. The experience gained and the research accomplished clearly demonstrate the special values of Educational Television as an aid to implementing the instructional goals of schools and institutions of higher learning and in serving the educational and cultural needs of the general public in the thousands of communities in the region.

Hence the study of program resources in this area can be made against an impressive background of National Educational Television program development, as well as the regional experience accumulated during the years subsequent to the early pioneering ventures in the Upper Midwest Area.

PART II

METHODS EMPLOYED IN THE SURVEY

It is evident that the answers to the following questions are germane to the study of Educational Television Program Resources in the Upper Midwest Area.

1) What is the past Educational Television program experience in the six states comprising the proposed network area?
2) What is the present status of Educational Television programming in these six states?
3) What are the program resources in local areas which would likely be of interest to the entire network region?
4) What types of programs originating from other than local sources would be most welcome as additions to the local programming output of each existing or proposed educational television station?
5) What is the outlook for future Educational Television program development in the Upper Midwest Area?

Answers to these broad questions were sought out by the following methods:

a) Direct communication with institutions identified as having used television (as found in listings such as the Michigan State University Continuing Education Service Compendia of Telecourses for Credit).
b) Personal contact and other communications with administrators and faculty members of institutions participating in Educational Television activities.
c) Communication with State Departments of Public Instruction and local educational administrators.

d) Personal contact and other communication with community leaders both in locations where Educational Television stations exist and where planning for Educational Television is in progress.

e) Personal contact with administrative personnel of Educational Television stations now in operation.

f) Communication with administrators and faculty members of institutions not participating in Educational Television activities but whose activity therein would affect the resources available to the proposed network.

g) Assaying of organizational and curriculum data of the institutions of higher learning in the six states.

h) Review of all available records describing past and present programming activities of the region's existing Educational Television stations.

PART III

EDUCATIONAL TELEVISION PROGRAM EXPERIENCE IN THE UPPER MIDWEST AREA*

A. Amount of Educational Television Program Experience

The impressive amount of Educational Television experience which has been gained in the Upper Midwest Area is one of the best indicators of program resources.

In seeking answers to the question, "How much Educational Television programming has been accomplished, by whom was it presented and what was its nature?", many different facts and inferences pertinent to a study of program resources emerged.

Some of these data, such as the listing of programs, the number of hours broadcast, the number of institutions involved, etc., can be fairly accurately tabulated. Other information, for example the assessment of the relative effectiveness of a "performer", can not be so readily catalogued. This second kind of information came, for the most part, from ETV station personnel whose evaluations are based on records of public response as well as their own professional judgement.

Only the locally produced "live" programs are considered, and three arbitrarily-selected program categories are introduced in this section.

1. Systematic Adult Instruction, Credit or Non-Credit
   Program series whose value to the viewer depends on cumulative viewing of the entire series.
2. In-School Programs
   Elementary and Secondary School programs for use in classrooms.

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*To January 1, 1960

3. General Programs

Programs of general community interest and all others not included in the above.

Within approximately 26,812 hours of total educational telecasting, over 25,500 locally produced "live" programs have been presented. (Appendix 1)

Almost 4,900 individual programs in 259 Systematic Adult Instruction courses, varying from 6 to 33 programs per series, were telecast. Of these series, 154 were offered for college level credit, while 105 had no formal credit arrangement. (Appendix 2)

Of approximately 4,875 programs produced for school use, a total of 163 program series have been broadcast. These include 118 series on the elementary level and 45 for Junior and Senior High Schools. (Appendix 3)

Other than the Systematic Adult Instruction and In-School programs, there were 15,760 educational programs telecast in the Six States prior to 1960.

The sheer volume of program experience represented by this number of programs clearly indicates a wealth of program resources.

B. Sources of Educational Television Programs

The implementation of the thousands of programs required the involvement of many diverse agencies and people.

First, because the staff members of the Educational Television stations participate most actively in the preparation and presentation of all programs, their contribution to the identification and development of program resources has been crucial.

Institutions of higher learning have been active in producing not only formal college courses but programs of broad general appeal. The increasing numbers of faculty members who desire to appear on these programs is evidence of added program resources for the future.

School systems have gained experience through presenting and using a large percentage of the total amount of educational programming. (Appendix 3) The marked increase in numbers of in-school programs within the last three years suggests an expanding body of program experience which can be of major benefit to the entire educational structure.

Participation in the thousands of programs by other agencies and organizations from the community (discussion of which appears later) has stimulated many of these organizations to use television on a regular basis in order to extend the impact of their community service activities. The cumulative experience of such groups continually adds to the total of program resources available.

The study of program schedules coupled with estimates made by station personnel reveals an impressive participation in Educational Television by teachers, professional men and women, college personnel, etc.

Over 1000 University and College faculty members, 315 school teachers and 4500 community leaders have appeared in prominent roles on Educational Television programs in the six states.

C. Types of Educational Television Programs

1. Systematic Adult Instruction, Credit and Non-credit Courses

Thirty-one different subject areas encompass the one hundred and fifty-four separate credit courses telecast in the six states; the five most frequently appearing being Education, Psychology, Sociology, History, and Philosophy. The first five, when ranked by total number of programs devoted to each subject area are: Psychology, Education, History, Philosophy and Government. Tabulation of all credit courses, compiled by using the listed course title, can be found in Appendix 2 .

It should be noted that the use of course titles alone (the only information available in many cases) does not indicate the diversity of subject matter. For example, the subject area shown as "Education" may include "Problems in Reading", "Group Evaluating Techniques", etc. Even so, the span of subject matter listed shows that program resources are in no way limited to a few specialized subjects.

One hundred and five separate adult non-credit courses are included in the thirty-one subject areas having been telecast in the Six States; the five most often presented being Psychology, Literature, Home Finance, Agricultural Subjects and Government. The tabulation of these programs (Appendix 2) reveals the variety of subjects that have been available to adults who are interested in continuing education.

2. In-School Programs

One hundred and eighteen separate series of varying lengths in sixteen subject areas were presented for use in the elementary schools. The five appearing most often as series are Science, Music, Social Studies, Art and Hygiene. When ranked by total number of programs, however, the first five are Science, Music, Social Studies, History and Art.

Of particular note is the fact that almost one-third of the entire number of individual programs produced for elementary school use were in Science and, although lessons were not always directed toward a single grade level, fifth grade Science was by far the most often-presented subject.

Forty-five separate series or courses were telecast in sixteen subject areas for the secondary schools. The five most often presented series were in Science, History, Guidance, Biology and Literature. Because of the greater difference in number of programs per series in the secondary school lessons, the ranking in terms of numbers of programs per subject area becomes: History, Literature, Geometry, Science and Algebra.

In both elementary and secondary schools the emphasis on certain subjects results from the schools' assessment of their own needs. Because it is unlikely that these needs will change in the near future, the television experience that has been gained in these subjects will be particularly valuable for future program resource reference.

3. General Programs

The 15,760 programs, other than those classified as systematic adult instruction or in-school programs, include educational topics of such a diversity that the individual interests of every member of the community have been served at one time or another.

The following list of merely the program titles of only a portion of the live series that have been presented on the existing ETV stations reveals the different types of program resources available.

Describing each series would be too lengthy a procedure for this report. It is sufficient to note that these series (varying from 4 to 145 programs in length) were designed for all different age groups over the broadest span of subject matter and were presented in a variety of ways.

Todays Farm
Todays Home
Faculty Forum
Your Growing Child
Spanish for Travelers
Behind the Weather
The Friendly Giant
Drama in Poetry
March of Medicine
Creative Crafts
For Teachers Only
Journalism in Perspective
Dance Impromptu
The Flower Box
World Affairs Comment
House and Home
On the Rural Route
The Art Galleries
Let's Visit School
The 4-H Show
Your Unicameral
Sports of the Mrs.
County Agents Comments
Photography
Your Dental Health
Minneapolis Symphony Rehearsal
In Search of Science
Literature for Children
Consumer's Economics
Heartbeat (Heart Assn. Pgm.)
Current Books
Gardening
At Home With Music
This Is The Law
The Arts Around Us
Wildlife Resources
Great World Literature
Invest Intelligently
Current Issues
Town and Country (Ag. Subjects)
Camera On Your Mind (Self-understanding)
Children's Fair
The Novel in Our Time
Careers
Museum Art Center
Business in the Home
Community on Camera
Spanish
Words to the Wise (Teenage Problems)

Let's Go Shopping
Music Clinic
Rural Art Show
TV Story Time
Inside Sports
Animal Behavior
Exploring the News
Tax Facts
Of Books and Such
Music Album
Do You Know Music
Views of Youth
TV Drama Quartet
Learn to Swim
Puppet Workshop
Backyard Farmer
PTA Teletalks
The Story Lady
Civil Defense
The Museum Story
Visiting Professor
Drama Rehearsal
Fun With French
Creative Thinking
Great Disagreements
History of Architecture
Money Matters (Finance for teens)
Minority Problems
Great Books
Plant Biology
Music and Man
Meet the Engineer
Junior Highs on Parade
The Art Institute
Russkii Klass
The Bible, Old Book, New Look
Inquiry (public affairs forum)
Drama and the Theatre
Teens at the Crossroads
It's Your Business (Tax, etc. info.)
Faces of the City (Urban renewal)
Focus on Conflict (Current Affairs)
Teens Talk Books
Anthropology
The Arts
The Grant Pursuit (Philosophy, Science, Arts)
Know Your Schools

The people who were involved in the production of such programs represent a cross section of opinion leadership in the community. Business and professional men and women; local, state and national public officials; educators; housewives; civic action group members; workers; service club members; clergymen; etc., have appeared on educational programs.

As noted previously, about 4500 of these community leaders have taken prominent on-the-air roles in ETV programs. The vast number of others who have been active in planning, research, writing and other behind-the-scenes production functions would be almost impossible to assess.

PART IV

THE PRESENT STATUS OF EDUCATIONAL TELEVISION PROGRAMMING IN THE UPPER MIDWEST AREA

Each week nearly 200 locally-produced educational programs are presented in the Upper Midwest Area at this time. Of the 108 separate series on the air, 18% are adult level instructional programs for which college credit may be gained, 35% are programs produced for in-school use and the remaining 47% includes the programs classified in this report as general community programming.

These programs, as were those in the past, are presented through the combined efforts of Educational Television station personnel, institutions of higher learning and their faculties, public and non-public school systems and their personnel, and many community organizations and leaders. In short, a cross-section of the community is represented by those centers now active in Educational Television.

A listing of the presently scheduled programs (Appendix 4 and 4-a) again demonstrates the diversity in types of programs broadcast over Educational Television. There are, however, some trends which should be made known when comparing the present program schedules with those of only three years ago. First, the addition of three of the area's stations in the last three years more than doubled the total weekly program output. Second, very few in-school programs were being produced three years ago as compared to the thirty-eight separate series, most of which appear twice weekly, now being telecast to the schools.

This increase in daily use of television for instructional and enrichment purposes in the school curriculum has resulted in the addition of a number of new subject areas. In spite of this exploration of new subjects, the two still most emphasized on the elementary level are Science and Music, with an apparent trend toward an increasing amount of in-school programming of languages.

It should be noted at this point that, because this section deals with program resources, the foregoing discussion deals only with the locally produced "live" programs. The total number of hours of programming directed to the schools, however, is augmented considerably by the use of filmed materials and kinescope reproductions of lessons which afford more exposures for class viewing convenience.

Present programming in Educational Television also reveals an increase in the number of different subjects offered for college credit, as well as the inclusion of more general community program series whose content organization from week to week demands more than occasional viewing.

It is sufficient to say that the overall picture of current Educational Television programming in the six states, when viewed in the light of the past, is one of continually accelerating growth. More institutions of higher learning are presenting courses, more school systems are producing programs for classroom use, more agencies from the community are involved in educational television, and increasing numbers of people from these organizations are participating in the greater number of programs being telecast.

PART V

PROGRAM RESOURCES

A. Introduction.

Reconsideration of the preceding sections which have discussed the Educational Television experience in the Upper Midwest Area will recall that Educational Television programs traditionally fall into three general classifications:

1) Systematic Adult Instruction for students of higher education.

2) Programs for students in the public and non-public schools. (In-School Programs)

3) General Programs not included in the above two categories.

These program types have a strong relationship with the three main classifications of program resources most desirable for educational television programming.

Although some degree of interchange between classifications is common, it is construed that program resources may be categorized for purposes of this report in the following manner:

1) Resources from institutions of higher learning.

2) Resources from the public and non-public schools.

3) Community resources and those which are not found in either of the above.

To a high, but certainly not mutually exclusive degree, programs for students of higher education are found in the institutions of higher education. Similarly, programs used in the school classrooms from kindergarten through the twelfth grade almost always find their best source in the various schools of that level, and a high proportion of the general programs of a non-systematic nature may be found not only in both but particularly in the varied and rich resources of the many communities, meaning the civic, governmental, private and other agencies and social institutions found therein.

Thus, the total program resources available to the six states via the proposed facilities of the network are given consideration in this three-fold manner.

B. Institutions of Higher Learning.

Large and small, generalized and specific, there exist nearly 200 institutions of higher learning in the six-state area which have been considered in this report. Despite individual differences in size, emphasis, scope of teaching activity, curricula offered and term of study, all are united toward the common end of providing higher education to an ever-increasing student body now numbering over 224,000. Virtually all are accredited institutions. Those that are not are working toward this goal. Faculty serving this student body numbers in excess of 20,000 and represents nearly every conceivable subject area.

It is readily apparent, however, that many institutions do not and cannot afford specialization or, in some cases, even adequate training in some of the subject areas in which they and their students may be interested. Therefore, in terms of educational programming via an existing Educational Television facility located adjacent or nearby, a paucity of certain subject matter for the interested community may be noted, while in other areas an abundance may prevail.

Thus, two interrelated factors must be considered in viewing potential network program resources from the institutions of higher learning in the region, particularly as concerns students enrolled in such institutions and with consideration, too, given the general audience in the surrounding communities. The factors are:

1) The indication of unique and special program resources within an institution.

2) The indication of those basic subjects which, as course offerings common to nearly all institutions or as general programming of regional interest, could be presented in the best possible manner to a greater number of students and to wider general audiences through cooperative use of the best available resources.

These resources may be revealed by the presence of a singular research facility and its staff, an experimental educational program, an excellent chorus, talented musicians in residence, individual teachers who are recognized authorities in specialized areas, or simply a gifted teacher who, through talent and experience, has demonstrated an unusual ability to communicate over television.

Although traveling to each of the institutions of higher learning in the six states would have been impossible, the information gained through over thirty separate visits to such centers of learning, coupled with other direct communication and correspondence with many more, merely documented the obvious expectation that there exists, within the six states' Colleges and Universities, a vast number of unique educational experiences now largely available only to those in attendance.

Among those institutions visited were, in North Dakota, the University of North Dakota at Grand Forks and The North Dakota Agricultural College at Fargo; The South Dakota Agricultural College at Brookings, The University of South Dakota at Vermillion and Augustana College in Sioux Falls, South Dakota; The University of Nebraska at Lincoln, Creighton University and the University of Omaha at Omaha, Nebraska; Iowa State University at Ames, The State University of Iowa at Iowa City; The University of Minnesota, Gustavus Adolphus, Macalester, St. Catherine's, St. Thomas, Concordia, St. Cloud and Bethel Colleges and Hamline University in Minnesota. Because of official and unofficial organizations and associations extant among the institutions, it was possible in many cases to secure some information about several institutions during a single visit to one of them.

Only a sample listing of the very many nationally recognized and unique facilities within the region's major institutions would include: a Radiation Research Laboratory, a Federal Forest Products Laboratory, an institute on Gerontology, a tractor testing facility, an Institute for Indian Research, a fish research laboratory, a Child Welfare Research Station, a solar energy research laboratory, a sorghum research laboratory, a cellular research laboratory, an hydraulic engineering laboratory, an animal disease laboratory, an Atomic Research Institute.

As might be expected, the concentration of major facilities such as medical schools with their specialized research laboratories and institutes lies within the larger institutions. It is noteworthy that several of the nation's most highly recognized facilities of this type are indigenous to the region. In many cases, however, colleges and universities with relatively small enrollments have unusually important specialties. Leading research and dissemination of information in certain specialized areas of agriculture, for instance, are not confined to the larger institutions, but are carried on in smaller institutions outside the major population centers and with varying emphases.

Several of the denominational and non-denominational liberal arts colleges have especially strong programs in, for example, Music, Literature, Drama and the Arts. Many are particularly strong in subjects such as Religion and Philosophy and such unusual curricula as Medical Technology and Medical Record Library studies. Because of their emphasis on the liberal arts, many are particularly noted for their resources in the Classics.

It is no surprise that the educational activities in agriculture and home economics in the six states are notable in quality and quantity. In state agricultural colleges and agricultural divisions of other institutions, large facilities for teaching and research exist along with widespread agricultural and home economics extension services. The resources here for general and specialized treatment of these subjects seem limitless. Testament to the traditions for extension work which have application to Educational Television programming are the many agricultural, home economics and industrial short courses and institutes which bring to many campuses hundreds of different groups each year dealing with a wide variety of subject matter.

Here again, although each institution may offer a well balanced general program for resident students as well as for off-campus groups, special facilities and personnel result in one institution's emphasis on Soils, another's on Horticulture, another's on Dairy Cattle Breeding, and so on.

Cultural program resources from educational institutions are widely dispersed. The chorus of one denominational liberal arts college has gained international acclaim for its music department. A widely renowned string quartet is in residence at one state university, and many musicians of national prominence are on music faculties of both large and small colleges. Superior drama and theatre departments exist in several institutions, and many faculties contain award-winning painters, sculptors, writers, poets, etc. More than one institution possesses an exceptional art gallery, and several museums of Science and History with special regional significance are connected with educational institutions.

Of course, the implication that merely the presence of a superior facility or distinguished person automatically represents an excellent television program resource must be avoided. It is quite true that not all distinguished scholars, researchers or even fine teachers are superior in television presentation. However, reports from institutions using television, and from educational television station personnel, clearly indicate that there is steadily increasing interest on the part of faculty members toward participation in Educational Television. Moreover, the very presence of the person or facility of note accessible to the television installation and its staff can mean that the knowledge and material represented can, in some fashion, reach audiences whether the teacher himself appears or not. Still the many scholars in each center who are already recognized as being notable and effective in television presentation add up to a significant total number throughout the region.

The reports of outstanding "performers" on television were not confined to those dealing with such subjects as History, Psychology, Government, etc., in which there has been the greatest amount of experience. Noteworthy "performers" among faculty members from specialized fields indicate a diversity of special talent. The many examples cited include: the authority on little-known Religions, the internationally recognized expert on the Soviet Union, the pianist acclaimed for his interpretations of certain difficult modern compositions, and the authority on specialized aspects of guided missiles and space physics.

Nearly every kind of educational institution in the six state area is involved in teacher education. State colleges whose primary mission is developing teachers, Land Grant Institutions with schools or departments of education, other universities and liberal arts colleges (both denominational and non-denominational) offering degrees in education, combine to present a picture of program resource wealth.

Although the educational requirements for teacher certification vary somewhat from state to state, there are many basic courses which are common to all. (In at least one state the resident requirements for teacher certification have been materially modified because of the availability of a variety of televised education courses springing from a number of institutions.) Similarly, although advanced courses are more specialized in all institutions, there is a significant amount of each college student's educational experience which, for all practical purposes, is nearly equivalent in all institutions.

This fact, coupled with the present urgent need for making available the best quality of instruction to the greatest number of students, points to the second factor mentioned in surveying the program resources from institutions of higher learning - that of selecting the most widely needed college credit courses and determining the best source for their presentation.

Choice of specific subjects which might best be offered on a regional basis would be made through mutual agreement of the institutions involved. However, preliminary suggestions from curriculum advisors included basic courses in Mathematics, History, Chemistry, Physics, and Languages. Organizing course content for use by disparate institutions, particularly in the basic subjects mentioned, seemed to present no insoluble problems to those contacted.

It should be noted here that the nationally-televised 1958 "Continental Classroom" physics course was offered for credit by several non-denominational private colleges, three Lutheran colleges, six Catholic colleges, three state universities and six state teachers colleges within the region - proof, to say the least, of the institutional universality of Physics. Another example of intercollegiate use of television comes from one of the six states in which college credit for certain television courses is offered by non-denominational institutions as well as colleges with Lutheran, Catholic, Methodist and Presbyterian backgrounds.

Thus, with literally thousands of classroom courses being offered students daily by colleges and universities in the six states, with the experience gained from the 154 courses televised in the past to students and the general public, with 19 courses now being presented, and with increasing faculty participation in the use of television, the problem will not be one of searching for merely adequate representation of needed educational programs. It will rather be one of determining which are the best of the many resources available for the subject matter in greatest demand.

C. PROGRAM RESOURCES FROM PUBLIC AND NON-PUBLIC SCHOOLS

Of increasing interest and value over the entire United States is the use of television to augment regular classroom teaching in public and non-public schools toward the end that, through television, more and improved teaching resources are made available to a greater number of classrooms. Again, in this area of Educational Television programming, the Upper Midwest Area contains much of the nation's pioneering effort and experience.

Although the use of television in elementary and secondary school classrooms extends to the limits of the coverage areas of educational stations, the majority of programs for in-school use are prepared through more centrally-located school facilities. With few exceptions, television teaching for school children is being accomplished by teachers from within the public or non-public school systems themselves, and the major portion of programs presented by or through the cooperation of schools are directed toward their classroom pupils, although most school systems supply some programs for in-service teacher information and also extend their adult education activities through television.

Potential resources, as in the case of colleges and universities, are indicated through studying the past program experience of schools and are also to be evaluated by studying the types of television programs with which the schools are presently involved. Reports from station personnel, school administrators and other teachers regarding especially effective programs and television teachers rounds out the picture.

Again, note should be taken of the concentration on particular subjects in each of the localities where television is used in schools. For instance, 31% of the programs directed to the elementary level have dealt with Science. Music, Art and Languages are next in overall emphasis.

The main reason for this duplication of subject matter from station to station lies in the logical desire of school curriculum organizers to develop television lessons in those subjects for which there is the greatest need, and in which television teaching can be most effective. This application of television allows the elementary classroom teacher whose special competence may not be, for example, in Science, Languages or Music, to take advantage of the careful preparation of lessons in these subjects by the especially qualified and talented teacher.

Very important to the study of network program resources in and for the schools is the corollary question: What is the present and potential use of these television lessons in the schools?

Three most significant answers emerge: First, as has been indicated, the greatest general classroom utilization of television is in the most needed subjects. Second, and in contrast, a particularly well organized and effective presentation even of materials with which the classroom teacher is quite familiar may sometimes result in high utilization. One example of this kind is indicated by the popularity among teachers of a series which taught, in a unique way, basic rules of safety for first graders. Third, and perhaps most important, is the use of television lessons in schools far beyond the metropolitan area. Literally thousands of county and rural schools whose size prevents their having extensive facilities, adequate numbers of teachers, and teachers qualified in special subject areas, lie within the coverage of present and proposed educational television stations. Over and over reports were made of schools whose only available science lessons, for example, were coming to them over television.

Because curriculum structure varies within the six states' schools, the question of coordinating curriculum for inter-school use naturally arises. Briefly, with the background of increasing numbers of examples of one school system making use of television lessons organized by another school system, the growing recognition of the quality of teaching in basic subjects which can be brought about by television and the crucial needs in smaller schools, the cooperative coordination of television curriculum within the six states was indicated to be no unmanageable problem. Indeed, in many areas where in-school programs are presented by one school system primarily for use in its own widely dispersed classrooms, other schools are making regular use of the programs as well. As one Iowa School curriculum specialist said while discussing the idea of the regional network, "The problems of inter-change of in-school programs can be readily solved".

Inquiry as to the presence of teachers who are more than ordinarily effective on television revealed a diversity of special talent, though perhaps it is the emphasis in each locality on common subject matter which led to the identification, for example, of four elementary science teachers and three language teachers as being the "best possible" in their subjects.

One vocational school was particularly proud of its teacher of elementary Mathematics. The exceptional pupil response to an elementary music teacher from one large school district was pointed out. The teacher of an afternoon adult education home economics program received literally thousands of requests for information from interested women viewers, and the history lessons taught by a teacher in one of the states has gained not only local but regional acclaim.

These are only a few of the examples which, with the growing numbers of teachers participating in television teaching, point to a wealth of program resources from public and non-public school systems.

D. PROGRAM RESOURCES FROM THE COMMUNITY

For convenience, "Program Resources From the Community" will be used to mean the sources of program material and talent other than those found within colleges, universities and schools. As indicated before, the use of this arbitrary category does not imply that there is a boundary between activities associated with centers of learning and the communities within which they are located. A large portion of faculty members for instance, are active in civic, cultural and other community affairs, while many facilities located on campuses are of general community interest.

Branches of national organizations whose activities and informational services are of general community benefit are found in hundreds of towns and cities in the six states and many organizations of purely local character have similar goals from city to city.

These organizations include civic groups and clubs, service clubs, health and social services organizations, business and professional associations, etc. The following partial listing of such organizations, the majority of which have been involved in educational television presentations, is indicative of program sources whose pooling of efforts on a regional basis could often result in far superior programs to those produced only by local memberships:

The League of Women Voters, Chamber of Commerce, Foreign Policy Association, American Association of University Women, Safety Council, Junior League, Heart Association, YMCA, YWCA, Cancer Society, Council of Churches, Boy Scouts, Red Cross, Bar Association, Medical Association, Veterans of Foreign Wars, American Legion, Business and Professional Women's Club, Press Association, Chemical Society, Music Teacher's Association, Insurance Association, Dental Society, Rotary, Exchange, Kiwanis, Knights of Columbus, Lions and Optimist Clubs.

State and other agencies whose informational services would be of regional value could also benefit from the essential economy of cooperative pooling of resources. Examples of a few of these agencies having used educational television in the Upper Midwest Area are: Highway Safety Departments, Conservation Departments, Health and Welfare agencies, Law Enforcement agencies and Recreation Departments.

Because agricultural activities are of such importance in the six states and because television can extend educational and informational services far beyond metropolitan limits, it is logical that particular attention be given the resources for agricultural and related subjects. Although most of the agricultural information services are connected directly or indirectly with educational institutions, the close relationship between the county agents, etc. and other community organizations suggests further mention of these resources in this section.

The large membership of such youth organizations as the 4-H Clubs, Future Farmers of America, Future Homemakers and

Horticultural Societies, etc. includes groups of people whose special interests and activities indicate rich program resources. Literally hundreds of County Fairs, Agricultural Expositions and State Fairs provide a high point in the year's experience for thousands of young people who are looking toward farm-related careers. Year-round television presentations, for example, by expert specialists in livestock judging, exhibit preparation, etc. would stimulate greater interest in and extend the opportunities for these experiences to many for whom they are now unavailable.

A dramatically effective combining of expert program resources from the community and educational institutions was made in one state wherein a continuing series of programs was scheduled in conjunction with regular meetings of viewing groups in rural areas. The television presentations, stimulating later discussion under the leadership of county agents and other community leaders, proved to be of great value. Such organizations as the Farm Bureau, Farmers Union and The Grange have within their membership authoritative spokesmen on many aspects of agriculture and should be considered valuable potential program resources.

State to state similarities with regard to specific crops and livestock suggests a value in regional exchange of information. Although Iowa may concentrate heavily on corn production and related research, other states also have centers of corn production. While dairy cattle in Wisconsin and beef cattle in Nebraska may be primary concerns of these two states, cattle raising is also of importance in the other states. In like manner the most current experience and research in the growing of the various varieties of wheat in Nebraska and North Dakota would be of interest to other agricultural centers. From this it can be seen that specialized program resources which are present in one geographical area because of its concentration on particular research and production could be extended to the entire region. Obviously, too, there are many agricultural and related subjects which are entirely common to all parts of the region.

A recent survey conducted through the Personnel Managers Association in a large metropolitan area shows yet another broad program resource from the community. Some 4000 comprehensive questionnaires filled out by working adults inquired as to their future training in a great variety of subjects. Perhaps the most striking result of the survey was the answer to the question: "Would you consider taking a course by educational television?" The answers were 2 to 1 in favor of taking courses by Educational Television. The fact that the survey was made is only one illustration of the increasing interest on the part of business and industry in furthering educational opportunities for all employees and in the recognition of television as a means of accomplishment.

Not only can the business community be looked to for program resources in supporting adult education through public institutions, but may supply special resources from within its own ranks. Many large concerns have established, in cooperation with their employees, training programs of some kind. Subject matter varies to a large extent, yet there appears to be a commonality of need for and approach to many basic subjects. Report writing, effective speaking, conference procedures, basic mathematics, basic electronics and time and methods management are examples of these common subjects. Too, some of the nation's best technical minds are found in the industries of the region, marking a unique community program resource which has, on some stations, already been employed for effective programming. The possibility of cooperative organization of these resources in order to offer the best possible quality of instruction to employees throughout the six states should not be overlooked.

A wealth of cultural program resources from the community exists in the six states. Milwaukee's Museum of Science and Human History, the Nebraska State Historical Society and Museum in Lincoln, Nebraska, the Des Moines Art Center in Iowa, the Minneapolis Institute of Art in Minnesota and Omaha's Joslyn Art Center are examples of community institutions whose exhibits and activities could supply continuing program material. Additionally, programs of regional interest can be developed from the vast amount of material and information residing in the Historical Societies of the six states.

The Minneapolis Symphony, ranked as one of the finest in the country, is not the only orchestral group whose performances could enrich a network program schedule. The Boys Town A-Cappella Choir in Omaha, Nebraska, is only one of the many fine community choral organizations.

Interest in drama is region-wide, with many summer stock and little theatre companies in existence. The "Wisconsin Idea Theatre" is an example of unique drama activity which has gained national attention. With many potential sources, regular drama presentations might be expected on a regional network without overextending any single source. Some children's theatre activity may suggest resources for much needed children's programs.

In one state the continuing presentation of Great Books discussions on Educational Television resulted in the formation of many new discussion groups. A similar extension of interest in literature could be expected from these and other programs using community library resources and literary figures throughout the region.

Special single programs or series could result from unusual resources available within the Upper Midwest Area. These might be of a permanent nature such as the new atomic power plants in several states, the Strategic Air Command headquarters, a taconite mining installation, the new circular hospital building, and the new dock loading facility. Accessible to existing and proposed stations in each state are a wide variety of physical phenomena, programs about which would be of wide general interest.

A most important resource from the community also would stem from meetings of national and international organizations which frequently occur in the large centers of the region. For example, the World Health Organization meeting brought to one city for a several week period the outstanding world figures in Medicine, many of whose views and experiences would have provided outstandingly fine television fare for the six state region. High points of such yearly meetings as the National Farm Institute could be shared with all of the states. In a like manner, the great number of Community Lecture and Concert series which bring local areas the most distinguished world visitors, point to still further program resources.

The foregoing examples of program resources from the community represent only a bare indication of the potential. It seems that, as in viewing other program resources in the six states, the problem would not be one of searching but selection.

PART VI

TYPES OF POTENTIAL NETWORK PROGRAMS DESIRED IN LOCAL AREAS

An indication of the needs and desires for general and specific types of programs in each local area is important in assessing the overall and relative values of heretofore discussed program resources in relation to a potential network service.

Pertinent information from Educational Television stations came through discussion with station personnel, while other responses, in localities where no Educational Television Station yet exists, were in answer to the hypothetical question: "If the Educational Television Station were presently on the air what kind of programming would you welcome most from a cooperative network?"

Although the expressed wishes for specific types of programs varied somewhat from area to area, one overriding consideration was unanimously agreed upon. It was simply that network interchange of programs, even disregarding special resources, would result in a greater number of better quality programs being made available to the public. For a simple illustration: If 5 stations were to produce, each for its own local audience, 5 programs, a cooperative network interchange of these programs would result either in the availability of 25 programs to each audience with no increased effort on the part of local production personnel, or 5 programs on which 5 times as much production time could be spent, again with no extra burden to the local staff. Obviously, the availability of more and better quality programs through a network increases arithmetically as more stations and greater numbers of programs are involved.

Parenthetically, and presently most crucial, the hours of network service which could be offered through resources now available may be the only way in which sufficient initial programming could be scheduled in order to establish new Educational Television stations in some areas where they are most needed.

Responses revealed two general classifications of offerings as those which would be most welcome from a network. First, the kind of program whose presentation could not be accomplished locally because of a lack of resources and second, the kind of program which could be produced locally but, because of outstanding resources in another locality, would be more desirable through network interchange.

The first classification was discussed in general terms and there was a greater variety of "desired" types of programs in the areas where local resources are limited. However, almost unanimous expression indicated a wish for certain kinds of cultural programs. Symphony, Drama, and Dance were given as examples of general programs whose presentation would enhance the offering of each local station but whose origination would be limited to a few larger centers in the proposed network region.

Brief note should be made that often the desire for a specific kind of program for which there were no local resources came as the result of learning that the particular resources were available in another locality within the six states.

An unexpected response appeared in discussing the second classification of programs which would be most welcome from a network. The many expressions indicating a strong desire for more in-school programs, even from those already presenting relatively large amounts of school programming, were not anticipated. This general attitude may well be concommitant to the very rapidly growing interest in the use of television in schools and, although this evidence does not warrant any major conclusions, it is worthy of note in this study. Although the needs for out-of-school presentations directed toward pre-school and school age youngsters are being adequately met in some localities, in others there was a wish for added programming of this kind.

The desire was expressed, although with little discussion of specific subject matter, for adult level systematic instruction programs, particularly for college credit courses of the quality that could be afforded through network exchange.

Ideas for specific kinds of series which could be implemented through network interchange were advanced during the discussions. The production in each of the local areas of appropriate local segments of series built around themes of common regional interest was suggested as a potentially desirable adjunct to local programming.

Many "special" programs, such as dramatic productions, demand relatively large amounts of preparation time and hence appear infrequently if at all on local stations. Station representatives indicated that the increased frequency of this kind of offering through network interchange would be most desirable.

Another strongly expressed desire was for the kind of program which would deal with current regional happenings and several suggestions for programs in this broad category were made. Regular scheduling of news and commentary was suggested. It was pointed out that during each week there are persons of international prominence appearing in some area in the six states and that regularly scheduled network programs could supply a vehicle for their being seen and heard over the entire region. The value of the immediacy attendant to telecasting a special event of regional interest as it happens was indicated as an important factor in the desire for this kind of program.

A sampling of direct quotes from the discussions and other communications will show some of general and specific types of programs which were mentioned as being wanted.

"...We would be primarily interested in programming in areas where we were not particularly strong -- Philosophy, Languages, Elementary School training."

"...We are shooting at a largely rural group...shows relating to current social and economic change, as it affects these areas would be good."

"...We would most welcome the following kinds of material from the other five states:

Material dealing with leading national problems, in particular:

1. Traffic, highway and home safety.
2. Alcoholism.
3. The cost of living and its implications for the individual and the family.
4. Current practices and new development in education at the elementary, high school and college levels.
5. Considerations and developments in pure and applied research, translated for the layman.
6. "How to do it" subject matter for business, labor, civic groups and cultural groups.
7. The social sciences.
8. The "Art of intelligent living".

"...Classes for teachers - for instance to improve teaching through use of visual aids, etc."

"...We have been interested for some time in offering foreign language training at the high school level to the area. These programs would reach an area containing thousands of students in high schools so small that they cannot offer such instruction."

Lengthy comment on the relation between expressed local needs and program resources in the Upper Midwest Area is unnecessary. With few exceptions the types of programs most often mentioned as desirable are paralleled by particularly strong resources for the very same types of programs and in no case was there a request for specific subject matter that had not been presented on Educational Television at some time within the six states.

PART VII

AUDIENCE POTENTIAL

Important consideration must be given the groups who would benefit from the televising of program material originating from the resources described in the previous pages. For purposes of illustration, the total available audience has been tabulated in three main categories which have a logical interrelationship with the three broad types of educational television programs:

1) Population in the six-state region
2) Public and non-public school enrollment in the region
3) Enrollment in the region's institutions of higher learning

The table in Appendix 5 describes the totality of the six-state proposed network in terms of numbers of persons in these three categories who are in reliable range of the planned television signals under both primary and secondary systems. Computations are based on counties in each state which are totally within the coverage radii of the signals emanating from the various existing and proposed stations or transmitters, or where the computed signal strength is sufficient to include a significantly large proportion of the county.

For the convenience of officials in each of the six states, further detailed data is furnished for each state in Appendices 6 through 11(a), describing the coverage on a county-by-county basis in terms of total county population, total public and non-public school enrollment through 12th grade, and names and total enrollment in institutions of higher learning located within the areas of proposed coverage. Shown also are the proportions of coverage of those audiences to the state total.

Data used in the audience tables was secured from a wide variety of sources and in each case represents the most recent and most official available. Population figures shown are estimates as of January 1, 1960, reproduced here with the permission of Standard Rate and Data Service; College and University enrollment figures are, insofar as available, official reports as of Fall, 1959; Public and non-public school enrollments are based on official county-by-county reports of the various State Departments of Education again, where possible, as of Fall, 1959, except for Wisconsin where official total estimates for Fall, 1959, were employed and older county-by-county figures were brought up to date by factorial methods.

PART VIII

THE OUTLOOK FOR FUTURE EDUCATIONAL TELEVISION PROGRAM DEVELOPMENT

The outlook for future Educational Television program development can be stated simply as one of satisfying anticipated needs and desires for more programs, better programs and a wider range of subject matter. While it would be inaccurate to declare that such needs are measurable by systematic means, it is possible to outline for consideration the causative factors which will eventuate the predicted development.

Despite the vast amount of Educational Television program experience in the six-state area, the full force of its potential as an extension of the on-going educational process has hardly been felt except in the areas where Educational Television stations exist. And although the region's experience with Educational Television marked it as one of the earliest pioneers, the decade has been but a comparative instant when placed alongside the centuries of traditional methods of teaching and communication. Yet, where Educational Television may have been viewed with mild suspicion a decade ago, it is now almost universally recognized by educational officials as a potentially valuable and perhaps necessary tool of the educational function of society. The experiences of thousands of hours of televised presentation for teaching and for appreciative purposes, along with the awareness in educational circles of the hundreds of scientific experiments and research studies inquiring into the value of television in education has prepared the way for ever-increasing acceptance and use of the medium for the satisfaction of educational needs. Nor to be ignored is the official recognition of its efficacy by accrediting associations and other professional and official agencies. Perhaps most important in this context is the omnipresence of educational television in the region and the fact that it is being used today by highly regarded institutions and schools to further their educational work.

This acceptance, recognition and use have already produced a pronounced effect on program resources in that they have generated new resources or the machinery to employ existing resources. Schools, colleges, and community agencies are increasing their use of television as noted earlier in this report. Television facilities are being planned and incorporated into new school and college classroom buildings. Rare indeed is the institution of higher learning without a department, a faculty committee or a faculty member appointed to prepare programs or to be responsible for study and coordination of television teaching and utilization. Many institutions in the region have assembled staffs and facilities to implement anticipated production needs for programs and research into television use.

A parenthetic but important factor of note is the recognized increase in interest on the part of the general public for educational subjects. To dwell at length on anticipated burgeoning of school and college enrollments, the imminent sky-rocketing of costs of education and the shortage of qualified teachers is not necessary here. But these, too, are among the basic factors which will affect future program development and the resources of programs.

The accelerating demand upon educational program resources may be expected to take the form of increasing not only the numbers of programs but the quality of programs as well. More experience will yield higher quality, and the experimentation in wider areas of subject matter will result in regular presentation of a greater number of subjects. To teach or communicate by television will be an intrinsic mandate to secure the most capable teachers and communicators. Accomplishment of the triple goals of more programs, better programs and more diversification of subjects will require constant searching for the best teacher, the best techniques of presentation and the additional subject areas. Not all this may be found at one institution or single source. Therefore, new resources will be developed at perhaps hitherto overlooked points.

Evidence already exists in tangible form of actual "sharing" by school systems and colleges of educational resources, with television acting as the medium for the exchange. It can be anticipated that vastly increased amounts of sharing and exchange of resources will be the key to future program development.

PART IX

APPENDIX

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11 (a) Wisconsin Audience Potential

APPENDIX 1

EDUCATIONAL TELEVISION PROGRAM EXPERIENCE IN THE SIX STATES*

Educational TV Station, or Institution, providing programs on commercial stations where no ETV station exists	Approximate total broadcast hours	Approximate total "Live" programs
WHA-TV, University of Wisconsin, Madison Began operation March 26, 1954	3,300	2,600
KUON-TV, University of Nebraska, Lincoln Began operation November 1, 1954	6,400	3,500
KTCA-TV, St. Paul-Minneapolis, Minnesota Began operation September 3, 1957	4,200	3,860
WMVS-TV, Milwaukee, Wisconsin Began operation October 28, 1957	3,900	2,500
KDPS-TV, Des Moines, Iowa Began operation April 27, 1959	300	400
WOI-TV, Iowa State College, Ames Began operation February 21, 1950 (Note: WOI-TV, although owned by an educational institution, occupies a commercial channel and operates commercially. The totals listed here include only those which are considered educational in character)	8,000	11,000
The following institutions are known to have presented educational programs on commercial channels:		
University of North Dakota, Grand Forks North Dakota Agricultural College, Fargo Jamestown College, Jamestown, North Dakota Southern State Teachers College, Springfield, South Dakota Mount Mary College, Yankton, South Dakota Augustana College, Sioux Falls, South Dakota University of South Dakota, Vermillion University of Omaha, Omaha, Nebraska Creighton University, Omaha, Nebraska State University of Iowa, Iowa City Edgewood College of the Sacred Heart, Madison, Wisconsin Wisconsin State College, Superior, Wisconsin St. Norbert's College, West DePere, Wisconsin Marquette University, Milwaukee, Wisconsin University of Minnesota, Minneapolis, Minnesota Lawrence College, Appleton, Wisconsin Nebraska State Teachers College, Kearney	712	1,675
TOTALS	26,812	25,535

* Through January 1, 1960, as estimated by stations and institutions reporting. Station totals as shown above include television participation by many additional institutions other than those shown.

Excluded from this report are those programs on which institution faculty members appeared as guests on types of programs considered not important to this report.

APPENDIX 2

EDUCATIONAL TELEVISION PROGRAM EXPERIENCE IN THE UPPER MIDWEST AREA *

ADULT LEVEL SYSTEMATIC INSTRUCTION

Credit Courses			Non-credit Courses		
Subject	Number of separate series or courses	Aggregate number of programs	Subject	Number of separate series or courses	Aggregate number of programs
Psychology	14	345	Psychology	11	183
Education	18	308	Literature	7	142
History	10	248	Home Finance	7	112
Philosophy	9	215	Agricultural subjects	6	95
Government	9	190	Government	6	90
English	7	188	Vocational Guidance	3	88
Sociology	11	178	Music Education	5	79
Humanities	7	134	English	3	78
Music	6	129	History	6	72
Speech	6	112	Sociology	5	70
Political Science	7	111	Sports Education	4	56
Geography	5	107	Conservation	3	42
Religion	4	100	Philosophy	3	42
Mathematics	5	86	Home Economics Education	3	40
Spanish	3	78	Art	3	39
Area Studies	3	76	Chemistry	2	39
German	3	76	Speech	3	38
Astronomy	3	72	Crafts and Design	3	36
Art	4	64	Architecture	2	36
Literature	3	64	Russian	2	36
French	2	64	Astronomy	3	34
Business Administration	2	60	Health Education	1	32
Anthropology	2	46	Geography	1	32
Natural Science	3	39	Journalism	3	30
Slide Rule	2	36	Spanish	1	28
Botany	1	31	Home Nursing	1	22
Science History	1	18	Physics	2	18
Heredity	1	16	Lip Reading	2	16
Reading	1	16	Advertising	1	12
Guidance	1	13	Biology	1	12
Journalism	1	12	Geriatrics	1	11
Totals	154	3,232		105	1,660

Summary:

Number of separate series or courses
Credit....................154
Non-credit................105
Total 259

Number of aggregate programs
Credit....................3,232
Non-credit................1,660
Total 4,892

* to January 1, 1960

APPENDIX 3

EDUCATIONAL TELEVISION PROGRAM EXPERIENCE IN THE UPPER MIDWEST AREA*

IN-SCHOOL PROGRAMS

Elementary Level			Secondary Level		
Subject	Number of separate series or courses	Aggregate number of programs	Subject	Number of separate series or courses	Aggregate number of programs
Science	26	737	History	6	383
Music	19	269	Literature	4	260
Social Studies	12	266	Geometry	3	256
History	6	209	Science	8	255
Art	14	206	Algebra	2	192
Spanish	5	172	Biology	4	168
Reading	6	139	Art	3	160
Literature	4	104	Arithmetic	1	160
Story Telling (Reading Readiness)	3	77	Physics	1	160
Hygiene	11	76	English	1	160
Safety	3	30	Spanish	1	96
French	2	30	Guidance	5	77
Geography	1	28	Mathematics	1	64
Mathematics	2	26	Government	1	32
Speech	2	23	Social Studies	2	24
Writing	2	16	Hygiene	2	18
Totals	118	2,408	Totals	45	2,465

Summary:

Number of separate series or courses
Elementary....................118
Secondary.................... 45
Total 163

Aggregate number of programs
Elementary....................2,408
Secondary....................2,465
Total 4,873

Note:
Elementary level generally refers to grades 1-6; Secondary level generally refers to grades 7-12. Although there are local and regional differences in definition this grouping is most common.

* January 1, 1960

APPENDIX 4

PRESENT EDUCATIONAL TELEVISION PROGRAMMING IN THE UPPER MIDWEST AREA*

In-School Programs	Grade Level	In-School Programs	Grade Level
History	5-7	Music	5
Mathematics	5-6	Science	7
Reading	5-6	Science	3
News	5-6	Guidance Information	9
Geometry	Jr. High	Art	4
Music		Physics	Jr. Sr. High
Physics		Science	4
History		Safety First	1st
English	Sr. High	Music	5
Spanish	Elementary	French	Elementary
Science	5	Literature	6
Spanish	5-6	Biology	10
Science	6	Biology	11
Social Studies	11	Story Time	
History	7-8	U. S. History	10
Speech	Primary	U. S. History	11
3 Arts	5-6	Science	9
Science	5	Spanish	4
Music	2	Speech	1st

Systematic Adult Instruction	Systematic Adult Instruction
Freshman Forum	World & Physics
English	Anthropology
Music	Geography
Psychology	Sociology
Education	History
Great Philosophies	Political Science
Sacred Scripture	History of Science
German	Education (Guidance)
Psychology	Survey of English Literature
Basic Mathematics	

* Listing is by program title and includes only locally produced "live" programs appearing one or more times per week.

APPENDIX 4 (a)

PRESENT EDUCATIONAL TELEVISION PROGRAMMING IN THE UPPER MIDWEST AREA*

General Programming

Current Events
Art Appreciation
Campus Research
News
Weather
Meteorology
Nebraskan (Social Personality)
Passport (Russian Report)
Driver Education
Conversation Piece (Poetry)
University News (Current Issues)
Let's Visit School
Equation of Nature (Man Against Nature)
Issues (Safety Procedure)
Varsity Sports
Art Galleries
Polk Moves Ahead (County Issues)
American Politics (Current Policy)
The Arts
The Grand Pursuit (Philosophy, Science, Art)
Inflation
Current Issues
As Teachers Teach
Great Books
From Our Heritage
Liberal Arts in a Changing World
Through Eye and Ear

General Programming

Inquiry (Public Affairs Forum)
Observer(College Overview)
Power of Laughter
At Home With Music
When Numbers Are People (Minority Problems)
Adult Education
Town and Country (Agricultural Subjects)
One Man's Opinion
Sound of Literature
Children's Fair
Art Gallery
League of Women Voters (Issues in Politics)
Careers (Occupation)
Wee Weekly (Child Interest)
Words to the Wise (Counsel for Teens)
Profile (Current Events)
Video Sketchbook
Teens Talk Books
Gateway (Community Affairs)
On Camera
Books and Children
Montage (College Departments)
Campus Visits
Faculty Forum

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* Listing is by program title and includes only locally produced "live" programs appearing one or more times per week.

APPENDIX 5

AUDIENCE POTENTIAL

NAEB UPPER MIDWEST AREA

Population

State	Total State Population	Served by Primary System	%	Served by Primary and Secondary Systems*	%
Iowa	2,845,200	2,346,800	82%	2,346,800	82%
Minnesota	3,413,200	2,909,300	85%	2,909,300	85%
Nebraska	1,474,700	986,200	67%	1,297,600	88%
North Dakota	658,600	262,600	40%	620,200	94%
South Dakota	710,200	404,700	57%	697,400	98%
Wisconsin	4,007,100	2,820,900	70%	2,820,900	70%
Totals	13,109,000	9,730,500	74%	10,692,200	82%

Enrollment in Public and Non-Public Schools (K-12)

State	Total State Enrollment	Served by Primary System	%	Served by Primary and Secondary Systems*	%
Iowa	652,109	533,873	82%	533,873	82%
Minnesota	812,967	688,887	85%	688,887	85%
Nebraska	335,640	223,046	66%	291,681	87%
North Dakota	145,136	54,300	37%	137,072	94%
South Dakota	168,398	95,522	57%	165,889	98%
Wisconsin	900,000	601,452	67%	601,452	67%
Totals	3,014,250	2,197,080	73%	2,418,854	80%

Enrollment in Institutions of Higher Learning

State	Total State Enrollment	Served by Primary System	%	Served by Primary and Secondary Systems*	%
Iowa	51,307	46,400	90%	46,400	90%
Minnesota	59,094	54,233	92%	54,233	92%
Nebraska	25,155	21,465	85%	24,112	96%
North Dakota	13,137	9,755	74%	12,593	96%
South Dakota	12,998	9,965	77%	12,998	100%
Wisconsin	63,045	52,567	83%	52,567	83%
Totals	224,736	194,385	87%	202,903	90%

* Iowa, Minnesota and Wisconsin are not affected by addition of secondary network system.

APPENDIX 6

AUDIENCE POTENTIAL

IOWA

Summary of Coverage

Total State Population..2,845,200
  Served by Primary System..2,346,800(82%)

Total State Enrollment in Public and Non-Public Schools (K-12)..................... 652,109
  Served by Primary System.. 533,873(82%)

Total State Enrollment in Institutions of Higher Learning.......................... 51,307
  Served by Primary System.. 46,400(90%)

(NOTE: Iowa coverage is unaffected by addition of Secondary System)

Iowa Counties Covered Wholly or in Significant Part

Counties	Population	School Enrollment	Counties	Population	School Enrollment
Adair	11,800	1,802	Johnson	44,900	8,764
Adams	7,900	1,504	Jones	16,800	5,171
Appanoose	18,500	3,409	Keokuk	16,300	4,218
Audubon	12,100	2,509	Lee	44,300	10,421
Benton	22,400	5,877	Linn	137,300	30,953
Black Hawk	129,200	28,186	Louisa	11,600	2,773
Boone	28,100	5,551	Lucas	10,500	2,424
Buchanan	19,800	5,876	Lyon	15,300	3,726
Butler	16,400	4,445	Madison	12,600	2,914
Calhoun	15,900	4,615	Mahaska	23,000	4,586
Carroll	24,800	6,169	Marion	25,100	6,459
Cass	19,500	4,605	Marshall	36,400	8,678
Cedar	18,200	4,770	Mills	9,300	2,706
Clarke	9,200	1,868	Monona	15,400	3,380
Clinton	60,500	13,179	Monroe	10,100	2,139
Dallas	24,600	6,124	Muscatine	34,800	7,778
Davis	9,400	2,143	Plymouth	24,400	5,490
Decatur	12,000	2,328	Pocahontas	15,700	3,628
Delaware	16,800	3,783	Polk	282,000	59,449
Des Moines	52,600	10,191	Pottawattamie	76,900	20,274
Dubuque	88,100	19,109	Ringgold	8,600	2,010
Franklin	17,200	3,158	Sac	18,500	4,236
Fremont	10,900	2,475	Scott	131,000	27,122
Greene	15,600	3,450	Shelby	76,500	4,077
Grundy	14,800	3,537	Sioux	25,800	6,885
Guthrie	14,500	4,250	Story	44,800	9,811
Hamilton	20,600	5,080	Tama	22,800	5,187
Hancock	15,900	4,020	Union	16,200	3,271
Hardin	23,500	6,125	Van Buren	10,400	2,513
Harrison	17,700	4,460	Wapello	53,400	11,099
Henry	16,200	4,105	Warren	18,800	5,354
Humboldt	13,800	3,316	Washington	20,300	4,564
Iowa	15,600	4,476	Wayne	10,700	2,124
Jackson	17,800	5,292	Webster	49,700	11,171
Jasper	35,200	8,241	Winneshiek	21,600	4,120
Jefferson	16,600	3,025	Woodbury	110,700	26,000
			Wright	20,600	5,345
			TOTALS	2,346,800	533,873

APPENDIX 6 (a)

AUDIENCE POTENTIAL

IOWA

Institutions of Higher Learning in Iowa included in the areas covered by the Primary System, shown by name, location and enrollment.

Institutions	Location	Enrollment
Iowa State Teacher's College	Cedar Falls	3,425
Iowa State University	Ames	9,252
State University of Iowa	Iowa City	10,789
Central College	Pella	430
Chicago Evangelistic Institute	Oskaloosa	86
Clark College	Dubuque	809
Coe College	Cedar Rapids	843
Cornell College	Mt. Vernon	676
Drake University	Des Moines	5,800
Graceland College	Lamont	759
Grinnell College	Grinnell	1,016
Iowa Wesleyan	Mt. Pleasant	575
Loras College	Dubuque	1,318
Marycrest College	Davenport	677
Mount Mercy	Cedar Rapids	287
Parsons College	Fairfield	976
St. Ambrose College	Davenport	1,536
Simpson College	Indianola	672
University of Dubuque	Dubuque	571
Westmar College	LeMars	536
William Penn College	Oskaloosa	340
Des Moines-Still College of Osteo. & Surgery	Des Moines	270
Boone Jr. College	Boone	114
Burlington Jr. College	Burlington	332
Centerville Jr. College	Centerville	76
Clinton Jr. College	Clinton	132
Creston Jr. College	Creston	108
Eagle Grove Jr. College	Eagle Grove	110
Ellsworth Jr. College	Iowa Falls	196
Fort Dodge Jr. College	Fort Dodge	272
Keokuk Jr. College	Keokuk	160
Marshalltown Jr. College	Marshalltown	290
Muscatine Jr. College	Muscatine	229
Webster City Jr. College	Webster City	84
Grand View Jr. College	Des Moines	539
Mount St. Claire College	Clinton	214
Northwestern College	Orange City	292
Ottumwa Heights College	Ottumwa	180
Briarcliff College	Sioux City	421
Morningside College	Sioux City	1,018
	TOTAL ENROLLMENT SERVED	46,400

APPENDIX 7

AUDIENCE POTENTIAL

MINNESOTA

Summary of Coverage

Total State Population	3,413,200
Served by Primary System	2,909,300(85%)
Total State Enrollment in Public and Non-Public Schools (K-12)	812,967
Served by Primary System	688,887(85%)
Total State Enrollment in Institutions of Higher Learning	59,094
Served by Primary System	54,233(92%)

(NOTE: Minnesota coverage is unaffected by addition of Secondary System)

Minnesota Counties Covered Wholly or in Significant Part

Counties	Population	School Enrollment	Counties	Population	School Enrollment
Aitkin	12,200	3,007	Nicollet	25,100	3,396
Anoka	50,300	20,568	Norman	12,100	2,717
Becker	24,700	5,432	Olmsted	56,900	13,503
Benton	16,800	4,005	Otter Tail	53,300	10,661
Big Stone	9,800	2,658	Pennington	14,000	3,587
Blue Earth	43,300	11,152	Pine	16,600	4,229
Carlton	26,800	6,971	Pipestone	15,100	4,328
Carver	19,800	5,006	Polk	37,000	9,375
Chippewa	18,000	3,876	Pope	13,100	3,047
Chisago	13,100	3,244	Ramsey	429,900	99,386
Clay	35,400	9,124	Red Lake	6,700	1,721
Clearwater	9,900	2,345	Redwood	23,600	6,095
Dakota	61,100	18,784	Renville	25,200	6,399
Dodge	13,500	3,767	Rice	39,700	8,465
Douglas	23,900	5,502	Rock	12,400	2,775
Goodhue	34,800	8,033	Roseau	14,800	3,315
Grant	10,000	2,437	St. Louis	238,000	56,444
Hennepin	841,600	178,810	Scott	18,500	5,022
Isanti	12,300	2,672	Sherburne	11,700	2,298
Itasca	36,100	10,645	Sibley	16,000	3,620
Kanabec	9,500	2,082	Stearns	79,300	21,412
Kandiyohi	32,800	6,924	Steele	23,900	6,018
Kittson	9,300	2,378	Stevens	12,100	2,961
Lac Qui Parle	14,700	3,209	Swift	17,200	4,520
Lake	9,200	3,504	Todd	25,200	5,995
Le Sueur	20,500	4,417	Traverse	8,600	1,829
Lincoln	10,400	2,629	Wabasha	17,200	4,845
Lyon	24,800	6,575	Waseca	15,800	4,005
McLeod	24,800	6,373	Washington	44,500	11,337
Mahnomen	6,800	1,849	Wilkin	11,600	2,553
Marshall	15,500	3,563	Wright	30,000	7,857
Meeker	20,200	4,572	Yellow Medicine	16,300	4,232
Mille Lacs	16,000	4,827			
			TOTALS	2,909,300	688,887

APPENDIX 7 (a)

AUDIENCE POTENTIAL

MINNESOTA

Institutions of Higher Learning in Minnesota included in the areas covered by the Primary System, shown by name, location and enrollment.

Institutions	Location	Enrollment
Augsburg College	Minneapolis	1,173
Bethany Junior College	Mankato	100
Bethel College	St. Paul	571
Carleton College	Northfield	1,136
College of St. Benedict	St. Joseph	430
College of St. Catherine	St. Paul	1,175
College of St. Scholastica	Duluth	387
Concordia College	Moorhead	1,626
Concordia Junior College	St. Paul	372
Ely Junior College	Ely	139
Eveleth Junior College	Eveleth	102
Gustavus Adolphus College	St. Peter	1,167
Hamline University	St. Paul	1,049
Hibbing Junior College	Hibbing	476
Itasca Junior College	Itasca	296
Macalester College	St. Paul	1,778
Mankato State College	Mankato	4,465
Moorhead State College	Moorhead	1,297
Northwestern College	Minneapolis	368
Rochester Junior College	Rochester	633
St. Cloud State College	St. Cloud	3,333
St. John's University	St. Joseph	1,123
St. Olaf College	Northfield	1,811
St. Paul Bible College	St. Paul	234
St. Paul Seminary	St. Paul	341
St. Thomas College	St. Paul	1,735
University of Minnesota	Minneapolis, St. Paul, Duluth	26,538
Virginia Junior College	Virginia	378
	TOTAL ENROLLMENT SERVED	54,233

APPENDIX 8

AUDIENCE POTENTIAL

NEBRASKA

Summary of Coverage

Total State Population	1,474,700
Served by Primary System	986,200(67%)
Served by Primary and Secondary Systems	1,297,600(88%)
Total State Enrollment in Public and Non-Public Schools (K-12)	335,640
Served by Primary System	223,046(66%)
Served by Primary and Secondary Systems	291,681(87%)
Total State Enrollment in Institutions of Higher Learning	25,155
Served by Primary System	21,465(85%)
Served by Primary and Secondary Systems	24,112(96%)

Nebraska Counties Covered Wholly or in Significant Part

PRIMARY SYSTEM

Counties	Population	School Enrollment	Counties	Population	School Enrollment
Antelope	11,500	2,368	Lancaster	140,600	30,124
Boone	10,900	2,368	Madison	28,200	5,791
Boyd	4,500	1,258	Merrick	9,700	2,291
Burt	12,300	2,571	Nance	6,500	1,241
Butler	11,300	2,526	Nemeha	10,900	2,171
Cass	18,200	4,298	Otoe	17,800	4,034
Cedar	14,600	3,619	Pawnee	6,100	1,173
Clay	8,200	1,473	Pierce	10,200	2,159
Colfax	10,900	2,372	Platte	22,400	6,099
Cuming	14,300	2,904	Polk	8,400	1,627
Dakota	12,300	3,100	Saline	15,400	2,704
Dixon	8,900	2,218	Sarpy	22,400	7,079
Dodge	32,400	7,589	Saunders	18,400	4,243
Douglas	339,100	78,695	Seward	14,100	3,139
Fillmore	9,000	2,255	Stanton	7,200	1,317
Gage	27,600	6,187	Thayer	10,400	2,251
Hamilton	8,900	2,071	Thurston	8,100	2,105
Jefferson	12,500	2,531	Washington	11,400	2,749
Johnson	7,000	1,510	Wayne	11,800	1,998
Knox	15,400	3,535	York	16,400	3,303
			TOTALS SERVED BY PRIMARY SYSTEM	986,200	223,046

(See Appendix 8 (a) for County Coverage Under Secondary System)

APPENDIX 8 (a)

AUDIENCE POTENTIAL

NEBRASKA

NEBRASKA COUNTIES ADDED IN SECONDARY SYSTEM COVERAGE

SECONDARY SYSTEM

Counties	Population	School Enrollment	Counties	Population	School Enrollment
Adams	35,700	6,432	Holt	15,400	3,636
Blaine	1,000	219	Hooker	1,000	281
Brown	5,000	1,127	Howard	7,200	1,494
Buffalo	28,800	6,058	Kearney	7,000	1,527
Cherry	8,400	2,064	Keya Paha	1,500	374
Custer	18,600	4,109	Lincoln	31,500	7,599
Dawson	20,400	5,464	Logan	1,200	334
Franklyn	7,600	1,387	Loup	1,200	285
Frontier	5,000	1,133	McPherson	700	152
Furnas	10,200	2,114	Phelps	10,800	2,374
Garfield	2,800	696	Red Willow	12,700	3,119
Gosper	2,200	358	Rock	2,500	687
Greeley	5,300	1,493	Sherman	6,300	1,372
Hall	41,400	9,072	Thomas	1,000	346
Harlan	8,300	1,168	Valley	7,300	1,422
Hayes	2,100	416	Wheeler	1,300	323
		TOTALS SERVED BY SECONDARY SYSTEM		311,400	68,635
		GRAND TOTALS SERVED BY PRIMARY AND SECONDARY SYSTEMS		1,297,600	291,681

APPENDIX 8 (b)

AUDIENCE POTENTIAL

NEBRASKA

Institutions of Higher Learning in Nebraska included in the areas covered by the Primary System, shown by name, location and enrollment.

Institutions	Location	Enrollment
College of St. Mary	Omaha	402
Concordia Teachers College	Seward	615
Creighton University	Omaha	2,954
Dana College	Blair	377
Doane College	Crete	313
Duchesne College	Omaha	321
Fairbury Jr. College	Fairbury	236
Luther Jr. College	Wahoo	135
Midland College	Fremont	716
University of Omaha	Omaha	2,785
Nebraska State Teachers College	Peru	500
Nebraska State Teachers College	Wayne	1,262
Nebraska Wesleyan University	Lincoln	1,052
Norfolk Jr. College	Norfolk	312
Union College	Lincoln	776
University of Nebraska	Lincoln	8,629
York College	York	80
TOTAL SERVED BY PRIMARY SYSTEM		21,465

Institutions of Higher Learning in Nebraska included in the areas covered by the Secondary System, shown by name, location and enrollment.

Institutions	Location	Enrollment
Hastings College	Hastings	739
McCook Jr. College	McCook	298
Nebraska State Teachers College	Kearney	1,610
TOTAL SERVED BY SECONDARY SYSTEM		2,647

GRAND TOTAL SERVED BY PRIMARY AND SECONDARY SYSTEMS 24,112

APPENDIX 9

AUDIENCE POTENTIAL

NORTH DAKOTA

Summary of Coverage

Total State Population	658,600	
Served by Primary System	262,600	(40%)
Served by Primary and Secondary Systems	620,200	(94%)
Total State Enrollment in Public and Non-Public Schools (K-12)	145,136	
Served by Primary System	54,300	(37%)
Served by Primary and Secondary Systems	137,072	(94%)
Total State Enrollment in Institutions of Higher Learning	13,137	
Served by Primary System	9,755	(74%)
Served by Primary and Secondary Systems	12,593	(96%)

North Dakota Counties Covered Wholly or in Significant Part

PRIMARY SYSTEM

Counties	Population	School Enrollment	Counties	Population	School Enrollment
Barnes	16,700	3,457	Ramsey	15,200	3,285
Cass	70,000	13,891	Ransom	9,000	1,888
Cavalier	10,200	2,260	Richland	19,900	4,238
Eddy	5,500	1,132	Sargent	7,700	1,698
Grand Forks	45,300	9,019	Steele	4,900	1,050
Griggs	5,800	1,119	Traill	12,000	2,359
Nelson	8,400	1,740	Walsh	18,300	3,842
Pembina	13,700	3,322			
		TOTALS SERVED BY PRIMARY SYSTEM		262,600	54,300

North Dakota Counties Added in Secondary System Coverage

Counties	Population	School Enrollment	Counties	Population	School Enrollment
Adams	5,900	1,160	McIntosh	7,300	1,755
Benson	9,600	2,029	McKenzie	6,300	1,658
Billings	1,300	276	McLean	24,000	4,092
Bottineau	11,500	3,003	Mercer	8,400	1,749
Bowman	4,800	970	Morton	19,400	4,165
Burke	6,400	1,458	Mountrail	9,700	2,580
Burliegh	30,300	7,352	Oliver	2,800	649
Dickey	10,000	1,951	Pierce	8,700	1,946
Divide	5,600	1,223	Renville	6,000	1,249
Dunn	7,000	1,602	Rolette	11,600	2,648
Emmons	9,000	2,265	Sheridan	4,500	1,150
Golden Valley	4,300	910	Sioux	3,300	938
Grant	6,900	1,557	Slope	2,000	286
Hettinger	7,900	2,101	Stark	17,400	4,783
Kidder	6,700	1,420	Ward	41,300	9,908
LaMoure	10,100	2,383	Wells	11,100	2,479
Logan	6,000	1,432	Williams	17,600	5,447
McHenry	12,900	2,198			
		TOTALS SERVED BY SEDONDARY SYSTEM		357,600	82,772
		GRAND TOTALS SERVED BY PRIMARY AND SECONDARY SYSTEMS		620,200	137,072

APPENDIX 9 (a)

AUDIENCE POTENTIAL

NORTH DAKOTA

Institutions of Higher Learning in North Dakota included in the areas covered by the Primary System, shown by name, location and enrollment.

Institutions	Location	Enrollment
University of North Dakota	Grand Forks	3,886
North Dakota Agricultural College	Fargo	3,320
North Dakota State Teachers College	Mayville	582
North Dakota State Teachers College	Valley City	818
North Dakota State School of Science	Wahpeton	1,057
Devil's Lake Jr. College	Devil's Lake	92
TOTAL SERVED BY PRIMARY SYSTEM		9,755

Institutions of Higher Learning in North Dakota included in the areas covered by the Secondary System, shown by name, location and enrollment.

Institutions	Location	Enrollment
North Dakota State Teachers College	Dickinson	562
North Dakota State Teachers College	Ellendale	223
North Dakota State Teachers College	Minot	1,447
North Dakota State School of Forestry	Bottineau	180
Bismarck Jr. College	Bismarck	426
TOTAL SERVED BY SECONDARY SYSTEM		2,838
GRAND TOTAL SERVED BY PRIMARY AND SECONDARY SYSTEMS		12,593

APPENDIX 10

AUDIENCE POTENTIAL

SOUTH DAKOTA

Summary of Coverage

Total State Population	710,200	
Served by Primary System	404,700	(57%)
Served by Primary and Secondary Systems	697,400	(98%)
Total State Enrollment in Public and Non-Public Schools (K-12)	168,398	
Served by Primary System	95,522	(57%)
Served by Primary and Secondary Systems	165,889	(98%)
Total State Enrollment in Institutions of Higher Learning	12,998	
Served by Primary System	9,965	(77%)
Served by Primary and Secondary Systems	12,998	(100%)

South Dakota Counties Covered Wholly or in Significant Part

PRIMARY SYSTEM

Counties	Population	School Enrollment	Counties	Population	School Enrollment
Aurora	4,500	1,118	Hanson	5,000	1,263
Beadle	23,800	5,306	Hutchinson	10,900	2,474
Bon Homme	9,400	2,239	Jerauld	4,700	1,160
Brookings	19,100	3,936	Kingsbury	9,900	2,449
Brule	5,700	1,858	Lake	12,200	2,964
Charles Mix	16,900	3,115	Lincoln	13,500	3,078
Clay	9,700	2,021	McCook	8,800	2,110
Codington	22,200	6,151	Miner	5,500	1,363
Davison	18,900	3,964	Minnehaha	88,400	21,066
Day	10,600	2,553	Moody	8,800	2,417
Deuel	7,700	1,559	Roberts	14,300	4,461
Douglas	5,600	1,319	Sanborn	4,400	1,118
Grant	10,800	2,270	Turner	10,200	2,481
Gregory	8,500	1,858	Union	9,500	2,459
Hamlin	7,100	1,618	Yankton	18,100	3,774
		TOTALS SERVED BY PRIMARY SYSTEM		404,700	95,522

(See Appendix 10 (a) for County Coverage Under Secondary System)

APPENDIX 10 (a)

AUDIENCE POTENTIAL

SOUTH DAKOTA

SOUTH DAKOTA COUNTIES ADDED IN SECONDARY SYSTEM COVERAGE

SECONDARY SYSTEM

Counties	Population	School Enrollment	Counties	Population	School Enrollment
Brown	38,000	8,102	Laurence	17,300	4,315
Buffalo	1,600	357	Lyman	4,700	1,152
Butte	9,000	2,213	McPherson	6,300	1,288
Campbell	3,700	819	Marshall	7,200	1,695
Clark	6,800	1,661	Meade	12,700	2,557
Corson	6,100	1,547	Mellette	2,100	619
Custer	5,700	1,197	Pennington	60,500	14,182
Dewey	4,900	1,492	Potter	5,000	1,233
Edmunds	7,300	1,513	Shannon	6,500	2,696
Fall River	13,400	2,514	Spink	11,500	2,572
Faulk	4,900	1,076	Stanley	2,000	916
Haakon	3,100	838	Sully	2,800	623
Hand	7,400	1,757	Todd	4,400	1,559
Hughes	10,200	3,193	Tripp	9,100	1,975
Hyde	2,800	859	Walworth	8,600	1,994
Jackson	1,700	551	Washabaugh	1,400	270
Jones	2,100	523	Ziebach	1,900	509
		TOTAL SERVED BY SECONDARY SYSTEM		292,700	70,367
		GRAND TOTALS SERVED BY PRIMARY AND SECONDARY SYSTEMS		697,400	165,889

APPENDIX 10 (b)

AUDIENCE POTENTIAL

SOUTH DAKOTA

Institutions of Higher Learning in South Dakota included in the areas covered by the Primary System, shown by name, location and enrollment.

Institutions	Location	Enrollment
Augustana College	Sioux Falls	1,462
Dakota Wesleyan University	Mitchell	427
Freeman Jr. College	Freeman	61
General Beadle State Teachers College	Madison	416
Huron College	Huron	387
Mount Marty College	Yankton	304
Sioux Falls College	Sioux Falls	365
South Dakota State College	Brookings	3,410
Southern State Teachers College	Springfield	530
University of South Dakota	Vermillion	2,272
Wessington Springs Jr. College	Wessington Springs	48
Yankton College	Yankton	283
TOTAL SERVED BY PRIMARY SYSTEM		9,965

Institutions of Higher Learning in South Dakota included in the areas covered by the Secondary System, shown by name, location and enrollment.

Institutions	Location	Enrollment
Black Hills State Teachers College	Spearfish	671
Northern State Teachers College	Aberdeen	1,318
Presentation Jr. College	Aberdeen	205
South Dakota School of Mines	Rapid City	839
TOTAL SERVED BY SECONDARY SYSTEM		3,033

GRAND TOTAL SERVED BY PRIMARY AND SECONDARY SYSTEMS 12,998

APPENDIX 11

AUDIENCE POTENTIAL

WISCONSIN

Summary of Coverage

Total State Population	4,007,100	
Served by Primary System	2,820,900	(70%)
Total State Enrollment in Public and Non-Public Schools (K-12)	900,000	
Served by Primary System	601,452	(67%)
Total State Enrollment in Institutions of Higher Learning	63,045	
Served by Primary System	52,567	(83%)

(NOTE: Wisconsin Coverage is Unaffected by Addition of Secondary System)

Wisconsin Counties Covered Wholly or in Significant Part

Counties	Population	School Enrollment	Counties	Population	School Enrollment
Ashland	18,300	4,650	Ozaukee	29,600	6,540
Barron	39,900	11,400	Pepin	7,400	2,140
Bayfield	12,700	3,650	Pierce	23,600	6,550
Burnett	9,800	2,720	Polk	26,100	8,700
Calumet	22,700	3,250	Racine	132,200	28,900
Columbia	38,500	11,870	Rock	111,300	31,800
Dane	199,200	45,500	St. Croix	29,000	7,550
Dodge	65,900	11,900	Sauk	45,800	11,500
Douglas	48,300	11,412	Sawyer	9,600	3,000
Dunn	28,100	7,280	Sheboygan	94,100	19,600
Fond du Lac	77,500	14,500	Walworth	53,200	14,000
Green	27,400	7,650	Washburn	11,600	4,220
Green Lake	16,200	3,730	Washington	41,900	8,850
Iowa	19,600	5,370	Waukesha	130,900	33,300
Jefferson	51,700	11,840	Winnebago	170,500	23,000
Kenosha	93,400	21,350			
Manitowoc	76,700	14,730			
Milwaukee	1,058,200	199,000			
			TOTALS	2,820,900	601,452

APPENDIX 11 (a)

AUDIENCE POTENTIAL

WISCONSIN

Institutions of Higher Learning in Wisconsin included in the areas covered by the Primary System, shown by name, location and enrollment.

Institutions	Location	Enrollment
Alverno College	Milwaukee	979
Ashland County Teacher's College	Ashland	65
Barron County Teacher's College	Rice Lake	67
Beloit College	Beloit	1,011
Cardinal Stritch College	Milwaukee	979
Carroll College	Waukesha	767
Columbia County Teacher's College	Columbia	58
Concordia Jr. College	Milwaukee	174
Dodge County Teacher's College	Mayville	71
Dominican College	Racine	255
Edgewood College	Madison	417
Green County Teacher's College	Monroe	63
Holy Family College	Manitowoc	215
Lakeland College	Sheboygan	341
Layton School of Art	Milwaukee	307
Manitowoc County Teacher's College	Manitowoc	79
Marian College	Fond du Lac	215
Marquette University	Milwaukee	7,488
Milton College	Milton	340
Milwaukee Downer College	Milwaukee	178
Milwaukee Institute of Technology	Milwaukee	1,479
Milwaukee School of Engineering	Milwaukee	1,410
Mount Mary College	Milwaukee	1,062
Northland College	Ashland	362
Northwestern College	Watertown	148
Oshkosh State Teacher's College	Oshkosh	2,049
Polk County Teacher's College	St. Croix Falls	32
Racine-Kenosha County Teacher's College	Union Grove	121
Ripon College	Ripon	581
River Falls State Teacher's College	River Falls	1,233
Sauk County Teacher's College	Reedsburg	55
Sheboygan County Teacher's College	Sheboygan Falls	90
Stout State Teacher's College	Menominie	1,293
Superior State Teacher's College	Superior	1,346
University of Wisconsin	Madison, Milwaukee	25,492
Whitewater State Teacher's College	Whitewater	1,692
Wisconsin Conservatory of Music	Milwaukee	53
	TOTAL ENROLLMENT SERVED	52,567

JOINT ENGINEERING REPORT CONCERNING
NAEB UPPER MIDWEST AREA MICROWAVE RELAY SYSTEM

SUBMITTED BY:

JOHN KLINDWORTH
K & M ELECTRONICS CO., INC.

And

BERTEN A. HOLMBERG
REGISTERED ELECTRICAL ENGINEER

February 15, 1960

Dr. John C. Schwarzwalder
Director, KTCA-TV
St. Paul, Minnesota

Dear Dr. Schwarzwalder:

Transmitted herewith is our report on a Microwave System and Television Coverage for the NAEB Upper Midwest Area.

Only current F.C.C. Rules and current microwave equipment were considered in providing a system which could be constructed immediately if desired. Technical improvements will undoubtedly enhance the quality and capabilities of the system and can be incorporated when available.

We hope the information in this report will serve as your guide in expanding educational television service.

Respectfully submitted,

By: John Klindworth　　Berten A. Holmberg

John Klindworth, Pres.
K & M Electronics Co., Inc.

Berten A. Holmberg
Registered Electrical Engineer

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PART I

INTRODUCTION

1.1 Background.

In accordance with previous arrangements we submit herewith, tentative data and information which has been compiled concerning engineering aspects of a projected microwave network involving the several states comprising the NAEB's Upper Midwest Area. As set forth in other instruments and correspondence among the parties hereto, KTCA-TV, as recipient of a grant from the National Association of Educational Broadcasters, has retained the services of the following parties and in the manner prescribed below:

1.2 Professional Services.

(1) The Services of K & M Electronics Company, Inc.

This firm is to function as a research organization to collect, compile, and present in report form, technical information concerning the technical feasibility, design, estimated cost, and performance factors of the projected microwave system. The firm will also present engineering information and cost data covering the activation of reserved educational channels presently not operating in the NAEB Upper Midwest Area. This area includes Iowa, Minnesota, Nebraska, North Dakota, South Dakota and Wisconsin.

(2) The Services of Berten A. Holmberg, Registered Electrical Engineer.

Mr. Holmberg is to function as a Special Engineering Consultant to KTCA-TV in connection with the study project. He will act as liaison between and for KTCA-TV and the research organization in its conduct of the engineering study. He will also submit to KTCA-TV, professional reports evaluating and authenticating information that research on the system's design will provide.

PART II

DIGEST OF PRINCIPAL POINTS IN STUDY

2.1 Scope of Study.

The purpose of this study is to furnish engineering information and cost data for a television microwave network for the NAEB Upper Midwest Area.

As in any undertaking of the magnitude that a television network represents, there are many interrelated factors, both economic and technical, which must be examined by degrees. The first technical evaluation concerning the feasibility of the network being considered was contained in a brief preliminary report prepared by KTCA-TV in December, 1958, and for general appraisal in states comprising the NAEB Upper Midwest Area.

The second and more comprehensive technical inquiry concerning this project commenced in June, 1959, when work began on the intensive engineering that culminates with this report. Material included herein has been developed to the point of providing reliable cost estimates which can be used in the course of securing capital funds and operating budgets for a functioning network.

These estimates are by necessity based upon current conditions as to costs of all types as well as to the present state of the art in equipment design. There is on the horizon scientific developments which might conceivably alter the design of a network in either of several directions. These could possibly add to the costs shown while providing superior service or, conversely, might reduce costs somewhat while still providing service of a degree equal to that outlined in this report.

When and if funds of the magnitude outlined herein are reasonably assured, a third phase of engineering study will be required. At that time it will be necessary to re-examine the network design in the light of any new technical developments as well as possible changes in the general economy.

The third phase of the engineering study will involve at least the following:

1. Detailed examination of performance data on newer equipment.
2. Preparation of written specifications and other material related to bid-letting.
3. Preparation of Application for Construction Permit covering microwave repeater stations as well as allocation matters involving the Federal Communications Commission and other civil agencies.
4. Engineering participation in connection with securing sites, access, utilities, etc.
5. General Engineering Supervision of Network Construction and liaison with Prime Contractors.
6. Proof of Performance Measurements during and after the period of constructions.
7. Preparation and filing of performance data and Station License Applications with the F.C.C.

2.2 Organization.

It is difficult to envision that a facility as complex as the network to be described could operate efficiently without central administration and engineering supervision, at least along circuits comprising the principal loop. While it may be possible that extensive segments of responsibility for maintenance could be delegated by contract to suitably staffed subscriber organizations along the circuit, this participation should extend to some central agency which can insure uniform standards of performance and reliability.

The matters of efficient purchasing, traffic control, bookkeeping and legal responsibility alone, would require unit organization. Therefore, it has been assumed in all matters comprising this study, that the network, if constructed, would operate as a private non-profit common carrier corporation.

As has been pointed out in other sections of this study, the achievement of reasonably useful picture transmission over substantial segments of the network will require that adjustment to individual equipment units be highly optimized. It is felt that such maximum optimization cannot be met by a pattern of operation which permits a division of engineering responsibility over circuits which affect vital positions of the network. Therefore, the system must operate under a central agency.

It is the considered engineering opinion expressed in this report, that central responsibility for all technical aspects of network transmission be a mandatory specification for acceptable performance. It is also felt that similar firm measures of centralization are needed for traffic control operations which, of course, tie in closely with technical quality.

Initiation of the third phase of the engineering study referred to in paragraph three, should logically coincide with the establishment of the network's corporate structure, both administrative and engineering. Nearly all the points to be dealt with in this phase will require the network's ability to take action in a truly legal sense. This, of course, will make the existence of a legal structure, corporate or otherwise, literally mandatory.

2.3 Licensing and Allocation Considerations.

At the present time, the allocation of frequencies and construction permits for microwave stations comprising a network service might be given consideration under Section Rules 21.700, 4.601 (b) and 4.601 (c) of the Federal Communications Commission's Rules and Regulations. These services are entitled, respectively, as follows:

Nature of Service	Section
Point to Point Microwave Service (Common Carriers)	Rule 21.700 (et al)
Television STL Station (Studio - Transmitter Link)	Rule 4.601 (b) (et al)
Television Inter-City Relay Stations	Rule 4.601 (c) (et al)

The first of the above categories (Point to Point Microwave Service) is the only section rule under which common carrier corporations might seek appropriate construction permits for network circuits. The remaining two categories provide that the licensee must be an existing television broadcast station. In these latter two categories, it is not unusual to find rather extensive network links operated by individual stations or groups of stations that are unfavorably located with respect to common carrier trunks. However, these operators qualify for inter-city or long haul STL circuits by virtue of their status as licensed broadcasters rather than as common carriers.

In the latter two categories, legal responsibility for each repeater site must be assigned to a given broadcast station rather than to a group, unless of course all participating broadcast stations are commonly owned. An example of this form of network is described in Part 2.4 of this study in an evaluation by B. J. Klindworth.

As pointed out in other portions of this study, the necessity for unit control of both technical operations and traffic matters strongly suggests a structure based on common carrier principles. In this case, microwave frequency assignments and construction permits could be sought under the Rules and Regulations governing Point to Point Microwave Service, Rule 21.700.

2.4 Performance Prospectus and Anticipated Service Requirements of the Network.

The performance of the microwave network under study herein, judged from a strictly engineering point of view, is difficult to specify. It is rather certain that stations along the network that are adjacent to an originating station will receive rather high grade service which may well equal or conceivably exceed the performance of AT&T "long-haul" circuits.

Stations which lie at extreme points on the network route and furthest from an originating station will receive picture quality which by an industry definition may be considered "impaired." This level of impairment will vary progressively as the distance between the originating station and the point of utilization varies.

It is therefore entirely possible that the worst level of impairment will not produce a lower picture quality than that seen in kinescopes of moderate quality, assuming that the station selects the best of the two simultaneous feeds existing on the network. Some guidance in this matter can be obtained by reference to a separate report by John Klindworth based on observations made at the terminals of long microwave circuits in North Dakota. This report is submitted as follows:

MICROWAVE EVALUATION STUDY

By: John Klindworth

On July 23, 1959, Dr. Schwarzwalder, Wayne Mayer and myself traveled to Fargo, Bismarck, and Williston, North Dakota. Our first stop was at Fargo, N.D., where we visited with Julius Hetland of WDAY-TV. WDAY formerly received NBC network service through a closed loop AT&T microwave system in which nine hops of TD-2 equipment gave them very satisfactory service in both picture quality and reliability. During the last year this service was made more economical through use of an off-the-air pickup of Minneapolis NBC programs feeding six hops of TD-2 equipment and one hop of Motorola STL.

The television station engineers and viewers in the area had noticed impairment in picture quality when the switch to an off-the-air pickup was made. My personal evaluation of the picture quality was that the signal contained considerable high frequency noise which was probably produced by sound sub-carrier. There was a small amount of low-frequency smear as well as slight picture flutter present. The CBS picture at KXJB-TV showed slightly less noise or reduced bandwidth plus considerable picture smear and a definite loss of high frequencies. KXJB uses both CBS and ABC pictures and stated that the ABC quality was generally better, with the variations probably due to the pickup receiver at Zimmerman, Minnesota. As receivers are changed, the quality will change radically. In general, the pictures were very useable for monochrome, but they did not meet the color standards or the signal-to-noise standards of normal AT&T service.

The next stop was Bismarck, N.D., where station KFYR has NBC network service by an off-the-air pickup from WDAY which feeds four hops of microwave to their transmitter. This is a Bell Telephone Company service using Motorola STL microwave equipment. The quality of the signal was exceptionally good with very little additional degradation in picture quality than that observed at WDAY in Fargo. KBMB-TV of Bismarck is serviced by an independently owned and operated microwave system on 2000 mcs., using Federal links with subcarrier sound channel. Their service is an off-the-air pickup from Valley City passing through three hops to their transmitter. Again, this network picture was comparable to the CBS picture in Fargo with very little additional degradation apparent.

The picture was next checked at Williston, N.D., which has NBC service through seven hops of Lambda-Pacific STL equipment. This is a closed loop system which originates from the KFYR transmitter and is then fed by way of Minot to Williston. The quality of the picture at Williston was very good on local Bismarck shows and showed little additional degradation of the network signal. They are also using a subcarrier sound channel on the microwave which makes the operation of the system critical. The system provided a useable monochrome picture and indicated that reasonably good quality can be obtained through an off-the-air pickup feeding eleven hops of STL equipment as used between Fargo and Williston. Again, there was strong comment from Williston station engineers regarding the degradation of picture quality, since the economy service was instituted from Minneapolis. Previous to that time, their network picture had been considerably better.

Reliability of their network service is approximately 95%. There is an automatic provision in the system by which Williston can use a picture directly from Minot or the system can use the off-the-air signal of Bismarck in case of microwave failure on the first two hops out of Bismarck. When such an additional off-the-air signal is added to the system, there is further degradation of the picture.

In general, the picture quality through the 18 microwaves and two off-the-air pickups was above expectations and was very useable as well as being quite reliable. It appears that the first few hops of the microwave system cause the initial degradation in picture resolution. As the system was extended, additional loss in picture quality was hardly noticeable. This is undoubtedly related directly to the bandwidth capabilities of the microwave system operating with off-the-air pickups. It is generally not too difficult to maintain 2 to 3 mc. bandwidth which the final picture appeared to have at Williston.

Despite the fact that the circuits described in Mr. Klindworth's report must be classified as "impaired" from an engineering point of view, they were nonetheless serviceable and acceptable within the users' definition.

The following table portrays the factors of the distances and number of hops involved in some of the conceivable network paths. These of course, do not include additional networks which might tie in at some point on the system, and it does not include any of the secondary paths which utilized, in part, an off-the-air pickup.

	Miles	# of Hops
Total simultaneous circuit miles	1611	57
Longest interstation path via shortest direction (Grand Forks to Des Moines path circuit)	750	26

It is interesting to note that two manufacturers of equipment in the class being considered, state that the maximum number of repeaters for which they will hazard high grade microwave performance characteristics, are 8 hops and 13 hops respectively. This is in sharp contrast to the number of hops in the circuits under consideration and it gives some clues to the projections of performance being attempted herein. As desirable as it might be to place an actual engineering figure of merit on video information being transmitted through some of the longer paths in this system, the task goes beyond the present limits of inquiry into equipment of this class.

The equipment which is manufactured by AT&T for use in their system is, unfortunately, not available on the commercial market.

Most of this is custom built according to AT&T's laboratory specifications and the expense would prohibit its use.

Another factor which has not been mentioned up to this point is the matter of transmitting color video information through the system. While certain technical compromises might be accepted in a network of this type, as far as less than perfect black and white transmission is involved, the problems of color transmission through other than the shortest interstation paths will be compounded rapidly.

Since it can be argued that color, as an information bearing element, could be exploited in a large degree to convey necessary educational material, this factor should not be considered merely as a luxury or esthetic refinement. One need but refer to the vital role which color slides and film play in the classroom and laboratory to see the implication of color in educational television. These sharply contrast the novelty aspects of color in commercial telecasting. In all likelihood, color will become an increasingly valuable working tool in educational television.

Since magnetic recorders can now be equipped for color, it would seem that a microwave system which falls short in this respect might impair the potential of their future use in disseminating material of a scientific nature; medical research is only one of these. Accordingly, consideration may well be given to this in setting standards for a microwave system as is being studied in this project.

PART III

MICROWAVE NETWORK DESIGN AND CAPITAL COST ESTIMATES

3.1 General Considerations.

The microwave system proposed for Iowa, Minnesota, Nebraska, North Dakota, South Dakota, and Wisconsin is divided into two basic groups and referred to as primary and secondary. The primary section of the system consists of a complete closed loop, 2 way system, serving the primary VHF stations. All of the primary stations and the primary parts of the microwave system must be completed and put into operation for the system to be used as a network.

For coverage outside of the primary area, additional VHF channels have been added along with single direction microwaves using off-the-air pickups. These additional coverage facilities are listed as secondary equipment and secondary cost.

It should also be noted that the combined primary and secondary systems give each state its own state network service and VHF coverage. Individual state systems will allow each state to build its own system and to later join a regional network by integrating any portion of the microwave loop into a regional network operation.

State division of the primary network and separate state networks allows each state to proceed as funds permit and according to each state's needs. An individual state which can obtain funds could build its portion of the microwave system and use it as a state network until a regional network is put into service.

As far as can be determined at this time, the basic structural element in the proposed network serving stations in the Upper Midwest Area should embody a closed loop of repeaters. At three points along this loop there are branch circuits feeding the Duluth-Superior station, the stations in Fargo and Grand Forks, N.D., and WMVS-TV in Milwaukee, Wisconsin. The Duluth-Superior leg joins the loop at Minneapolis-St. Paul; the Fargo-Grand Forks leg joins at the Appleton, Minnesota station; and Milwaukee joins at WHA-TV in Madison, Wisconsin. All circuits tentatively proposed provide for two way transmission (primary origination and reception of network programs) by participating educational stations. The secondary branch extensions could not originate programs unless this portion of the circuit was augmented to include two way transmission.

As will be pointed out with more detail in a later section of this report, the present state of the art in available microwave apparatus leaves much to be desired where a system of this scope is being considered. While it is reasonably certain that useable picture quality will be provided throughout the system, this level of quality will not equal that of a high quality live television pickup.

The geographical location of the majority of the VHF reservations provides a loop in which it would be desirable to be able to have a microwave system capable of transmitting in either direction between adjacent stations. Transmission in either direction, theoretically could be accomplished through use of a single system whose direction could be reversed by remote switching. Transmission in either direction can also be provided by a dual system giving simultaneous, two direction service between adjacent stations.

In order that transmission through the many repeaters involved might be classified as useable from an empirical point of view, performance of each repeater station must be precisely optimized. At this time the degree of optimization required is considered to be wholly incompatible with the use of a reversing system and for the purpose of obtaining transmission in either of two directions throughout the system.

Actual operational experience in systems embodying fewer hops than proposed herein, has shown that precise adjustment is required for acceptable operation. No information can be obtained which would permit a conclusion to be made that this level of adjustment can be maintained where reversing apparatus is used. However, this conclusion does not preclude the possibility that newer and more sophisticated apparatus, which may become available in the foreseeable future, will permit reversibility of circuits with great precision and at reduced initial cost.

Meanwhile, it is necessary that tentative design be based on realizable factors. Accordingly, the two way circuits proposed for the primary system in this study consist of independent sets of apparatus for simultaneous operation in both directions throughout the system.

There are numerous advantages to this method which tend to outweigh added cost. Some of these are:

(A) High dependability of system due to the existence of two independent circuits feeding all principal points.

(B) Availability of the second circuit for use in either closed circuit transmission or diversity in network program scheduling.

(C) Opportunity for utmost optimization in all circuits comprising the system.

(D) Minimized need for supplementary apparatus to cover telemetering, remote tuning, and voice communications throughout the system.

(E) Greater opportunity for the inclusion of supplementary audio transmission services to educational radio stations.

The microwave system has been designed so that any available frequencies from 2000 mc. up to 13,000 mcs. may be used.

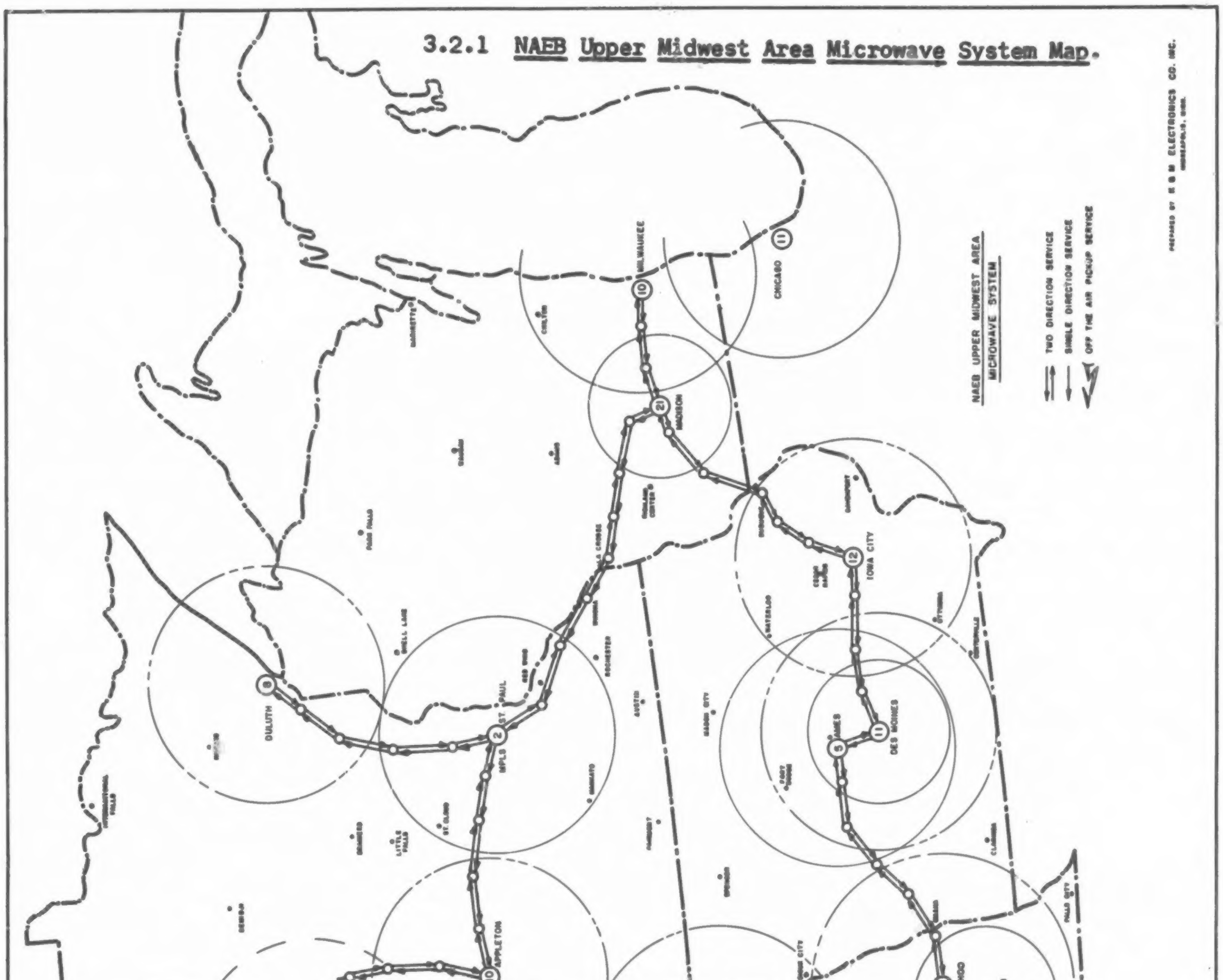
Technical developments may change the cost shown. However, the cost used in this study is the average cost for equipment being used by broadcasters in privately owned, multi-hop microwave systems.

The microwave system cost figures include standby emergency power at the intermediate towers, provisions for automatic switch over to off-the-air pickup at each second tower of each leg in case of equipment failure in either of the first two hops of each leg. The system includes terminal test equipment and three spare microwave units with cost being divided proportionally to each hop. Towers and all conceivable direct costs have been included in this cost study. All costs in this report are based on full list price without educational discount which is usually 10%, and no allowance for large contract discount. Some of this potential discount can be offset against cost of system installation and proof of performance provided by the contractor.

3.2 Information on the Map of the Microwave Network.

The microwave map shows the two-way primary network loop and branch legs, and the single direction secondary service utilizing off-the-air pickups. The VHF station coverages are overlaid to show the relationship between station coverage information and the microwave sites.

3.2.1 NAEB Upper Midwest Area Microwave System Map.


NAEB UPPER MIDWEST AREA
MICROWAVE SYSTEM
TWO DIRECTION SERVICE
SINGLE DIRECTION SERVICE
OFF THE AIR PICKUP SERVICE
PREPARED BY K B M ELECTRONICS CO. INC.
MINNEAPOLIS, MINN.
SCALE IN MILES
0
50
100
CHICAGO
11
MILWAUKEE
10
MADISON
21
IOWA CITY
12
DES MOINES
11
AMES
5
DULUTH
8
MPLS ST PAUL
2
APPLETON
10
GRAND FORKS
2
FARGO
13
MINOT
6
WILLISTON
11
BISMARCK
3
DICKINSON
4
ABERDEEN
2
PIERRE
10
RAPID CITY
11
FREEMAN
2
SIOUX FALLS
WAHOO
12
LINCOLN
12
AINSWORTH
3
LEXINGTON
4
NORTH PLATTE
LITTLE FALLS
ST CLOUD
ROCHESTER
RED WING
LA CROSSE
WATERLOO
CEDAR RAPIDS
DUBUQUE
SIOUX CITY
WATERTOWN
BROOKINGS
VERMILLION
VALLEY CITY
JAMESTOWN
INTERNATIONAL FALLS
PARK FALLS
MARQUETTE
SCOTTSBLUFF

3.3 Table Summarizing Total Estimated Capital Costs for the Upper Midwest Area Microwave Network.

3.3.1 Two Way Primary Microwave System Cost.

Leg #	Location	# of Hops	Distance	Primary Cost per Leg
1	St. Paul to Appleton	5	146	$ 191,596.00
2	Appleton to Vermillion	5	129	191,596.00
3	Vermillion to Lincoln	6	173	228,455.00
4	Lincoln to Ames	6	164	228,455.00
5	Ames to Des Moines	1	30	44,160.00
6	Des Moines to Iowa City	4	110	154,737.00
7	Iowa City to Madison	6	167	228,455.00
8	Madison to Milwaukee (Terminal Branch)	3	75	117,878.00
9	Madison to St. Paul	8	246	302,173.00
10	St. Paul to Duluth (Terminal Branch)	5	141	191,596.00
11	Appleton to Fargo	5	135	191,596.00
12	Fargo to Grand Forks (Terminal Branch)	3	95	117,878.00
		57	1611	$ 2,188,575.00

3.3.2 One Way Secondary Microwave System Cost with off-the-air Pickup.

Leg #		# of Hops	Distance	Secondary Cost
13	Grand Forks to Minot	4	102	$ 95,999
14	Minot to Williston	2	57	47,111
15	Fargo to Bismarck	4	133	95,999
16	Bismarck to Dickinson	1	41	22,667
17	Vermillion to Aberdeen	3	109	71,555
18	Vermillion to Pierre	4	125	95,999
19	Pierre to Rapid City	2	79	47,111
20	Lincoln to Lexington	3	106	71,555
21	Lexington to Ainsworth	1	43	22,667
		24	* 795	570,663

* Mileage does not include off-the-air pickup distance.

3.4 Table Showing Possible Division of Microwave Equipment Capital Costs Among States.

State	Primary Network Cost	Secondary Network Cost *
Iowa	$ 501,070.00	$ ________
Minnesota	781,163.00	________
Nebraska	191,596.00	94,222.00
North Dakota	139,958.00	261,776.00
South Dakota	228,455.00	214,665.00
Wisconsin	346,333.00	________
	$ 2,188,575.00	$ 570,663.00

* Secondary Cost includes the cost of the microwave transmitting equipment for the stations which are not necessary for operation of the Primary Microwave Network. These stations would function as part of a state network to extend coverage throughout each state.

3.5 Tables of Average Capital Costs "Per Hop," "Per Circuit Mile" and "Per Microwave Unit" in the System.

3.5.1 Two Way System.

Total Microwave Equipment Cost	$ 2,188,575

Total # of Hops 57

Total # of Miles 1611

Cost per hop $2,188,575/57 = $38,373/hop

Cost per mile 2,188,575/1611 = 1,358/mile

Cost per Microwave Unit $2,188,575/114 = $19,189/unit

3.5.2 One Way System

Total Equipment Cost	570,663

Total # of Hops 24

Total # of miles 795

Cost per hop $570,663/24 = $22,773/hop

Cost per mile 570,663/795 = 718/mile

3.6 Typical Equipment Schedules Used in Preparing Network Capital Costs.

3.6.1 Summary of Equipment Cost Schedules with Sample of how Cost per Leg is Computed.

Two Way Simultaneous Operation:

Basic Equipment per hop, Schedule A	$ 26,004.00
Fixed Cost per intermediate Tower, Schedule B	10,855.00
Terminal Equipment per leg, Schedule C	19,156.00

Single Direction Operation:

Basic Equipment per hop, Schedule D	13,589.00
Fixed Cost per intermediate Tower, Schedule B	10,855.00
Terminal Equipment per leg, Schedule E	9,078.00

Sample Computation for One Leg of System:

St. Paul to Appleton, 5 hop, 2 way operation:

5 x $26,004	$ 130,020.00
4 x 10,855	43,420.00
Terminal	18,156.00
TOTAL	$ 191,596.00

3.6.2 Basic Microwave Equipment Cost for 2 Way Repeater

SCHEDULE A

2	1.0 watt STL Microwave	$10,000.00	$20,000.00
2	Data Transmitter	188.00	376.00
2	Encoder	441.00	882.00
2	Carrier Switch	150.00	300.00
2	Set Waveguide Accessories	400.00	800.00
2	Load Isolators	300.00	600.00
1	Waveguide T		86.00
2	Waveguide Filters	275.00	550.00
2	8' x 12' Passive Reflectors	545.00	1,090.00
2	6' Parabolic Antenna	300.00	600.00
2	Antenna Feed Horns	175.00	350.00
2	Horizontal Mounts	60.00	120.00
2	Parabolic Heaters	125.00	250.00
			$26,004.00

3.6.3 Repeater Tower and Plant Facilities Cost (Either 1 Way or 2 Way System).

SCHEDULE B

1	250' Guyed Tower, Installed	5,500.00
1	8' x 10' x 8' Pre-fab Building	1,500.00
1	Site, including land and roads	1,500.00
1	Automatic Standby Power System	1,200.00
1	2KVA Voltage Regulator	430.00
1	Video Monitor with sound & demodulator	300.00
1	Scope	250.00
1	Meter	100.00
1	Rack Cabinet	75.00
		$10,855.00

3.6.4 Terminal Equipment Cost per leg Along 2 Way System.

SCHEDULE C

2	Data Receivers	$ 210.00	$ 420.00
2	Decoders	673.00	1,346.00
2	Conrac Receivers	295.00	590.00
2	VHF Antenna Systems	500.00	1,000.00
2	Sound Channel Systems	1,200.00	2,400.00
2	Sound Channel Failure Transmitters	700.00	1,400.00
2	Stabilizing Amplifiers	1,500.00	3,000.00
	Cost contribution for terminal test equipment, additional talk channel, and spare microwave units		8,000.00
			$ 18,156.00

3.6.5 Basic Microwave Equipment Cost per 1 Way Repeater.

SCHEDULE D

1	1.0 watt Microwave		10,000.00
1	Data Transmitter		188.00
1	Encoder		441.00
1	Carrier Switch		150.00
1	Set Waveguide Accessories		400.00
2	8' x 12' Passive Reflectors	545.00	1,090.00
2	6' Parabolic Antennas	300.00	600.00
2	Antenna Feed Horns	175.00	350.00
2	Horizontal Mounts	60.00	120.00
2	Parabolic Heaters	125.00	250.00
			$ 13,589.00

3.6.6. Terminal Equipment Cost per Leg Along 1 Way System.

SCHEDULE E

1	Data Receiver	$ 210.00
1	Decoder	673.00
1	Conrac Receiver	295.00
1	VHF Antenna System	500.00
1	Sound Channel System	1,200.00
1	Stab. Amplifier with Power Supply	1,500.00
1	Sound Channel Failure Transmitter	700.00
	Cost contribution for terminal test equipment, additional talk channel, and spare microwave units	4,000.00
		$ 9,078.00

PART IV

STUDY OF MICROWAVE NETWORK OPERATING COST ESTIMATES

4.1 Statement of General Requirements.

Maintenance cost for a system of this magnitude is difficult to determine since there are so few systems which are similar in size or in type of service from which to make a comparison. Although telephone companies have extensive information available, their systems are generally more complex and are engineered to provide a much higher degree of reliability due to the many diverse functions served.

The following cost estimates cover power, insurance, depreciation and maintenance personnel for the 2 way primary system. Due to the indefinite status of the VHF channels involved in the secondary system, detailed study of the 1 way system cost has not been made. The cost has only been estimated as a percentage of the 2 way system cost.

The power cost is computed directly by total power load at $.03 per KWH. The insurance has been determined from recent bids on insurance for equipment and tower installations similar to those used for UHF translator systems and other microwave systems. The depreciation is based on a uniform 10 year rate for all equipment.

The number of maintenance personnel for the primary network has been established at 13 plus one supervisor. This is based on dividing the system so each maintenance man will be responsible for approximately nine microwave units at five sites. The maintenance personnel will generally be located at intermediate sites rather than at the terminals, permitting the reduction in travel in the event of trouble. Through the cooperation of the station engineers at the terminal sites fault information can be relayed in such a manner as to minimize travel expense and unnecessary service calls.

Management costs of the network have not been included.

Upon investigating other microwave systems regarding relative maintenance costs, we found that one three hop system is being maintained for $125 per week, not including parts. However, the maintenance man would not renew the contract for this value after the second year because of the large amount of travel required to maintain the system. The actual number of hours required to repair a particular difficulty in the system was reasonable once the faulty repeater could be determined, but it was often necessary to start at the first site and go through the complete system to isolate troubles. Although fault indicating equipment was employed in this system it only showed actual outages and was of no help in locating qualitative troubles which caused picture degradation such as microphonics, sync compression, low frequency smear, etc. This experience indicates that extra telemetering of information may well reduce travel time of high cost maintenance personnel, outage time and other expenses.

Another installation involving 7 hops employed one full time maintenance man who lived near one of the intermediate sites and maintained five of the seven hops. Each of the end hops were maintained by personnel from the terminal stations. This system has been in service approximately three years and has improved its picture quality and reliability considerably over this period of time.

As in any complex electronic system, it can be expected that maintenance requirements will be higher the first year or two until the system problems are overcome and the personnel become more experienced.

The microwave site maintenance cost figure in this report has been shown as $1,000 per unit per year. This figure includes tubes, parts, building upkeep, road maintenance, tower maintenance, and all the miscellaneous costs required to keep the system in operation.

Division of operating cost among states has been allocated according to the number of 2 way primary system hops located in each state. Depreciation is in accordance with primary equipment cost allocated to each state. We feel that the operating cost estimates shown are conservative for a system of this size.

4.2 Table of Estimated Total Operating Cost and Depreciation.

Power for the System at $.03/kwh	$ 44,952
Insurance at a cost of $.75/hundred of cost	15,368
Maintenance	
13 Maintenance Personnel at $5,000	65,000
1 Supervisor	7,000
Transportation and Travel	36,400
Equipment, building, tower, land and road maintenance and upkeep at $1,000 per microwave unit	114,000
TOTAL	$ 282,720
Annual Depreciation Cost based on an equal rate over 10 years.	210,858
	$ 501,578

4.3 Table of Average Operating Cost.

Total Operating Cost	$ 282,720

Total Hops 57

Total Miles 1611

$282,720/57 hops = $ 4,960/hop

$282,720/1611 miles = 175/mile

$282,720/114 units = 2,480/unit

The operating cost of a single direction system is not computed here, but is estimated that it will be 65% of the 2 way operating cost per hop or per mile.

4.4 Table Showing Possible Division of Operating Cost and Depreciation Among States.

Iowa		
Annual operating cost	$ 64,480	
Depreciation	50,107	$ 114,587
Minnesota		
Annual operating cost	101,680	
Depreciation	78,116	179,796
Nebraska		
Annual operating cost	24,800	
Depreciation	19,160	43,960
North Dakota		
Annual operating cost	17,360	
Depreciation	13,996	31,356
South Dakota		
Annual operating cost	29,760	
Depreciation	22,846	52,606
Wisconsin		
Annual operating cost	44,640	
Depreciation	34,633	79,273
		$ 501,578

PART V

STUDY OF TOPOGRAPHICAL DATA ON NETWORK ROUTES

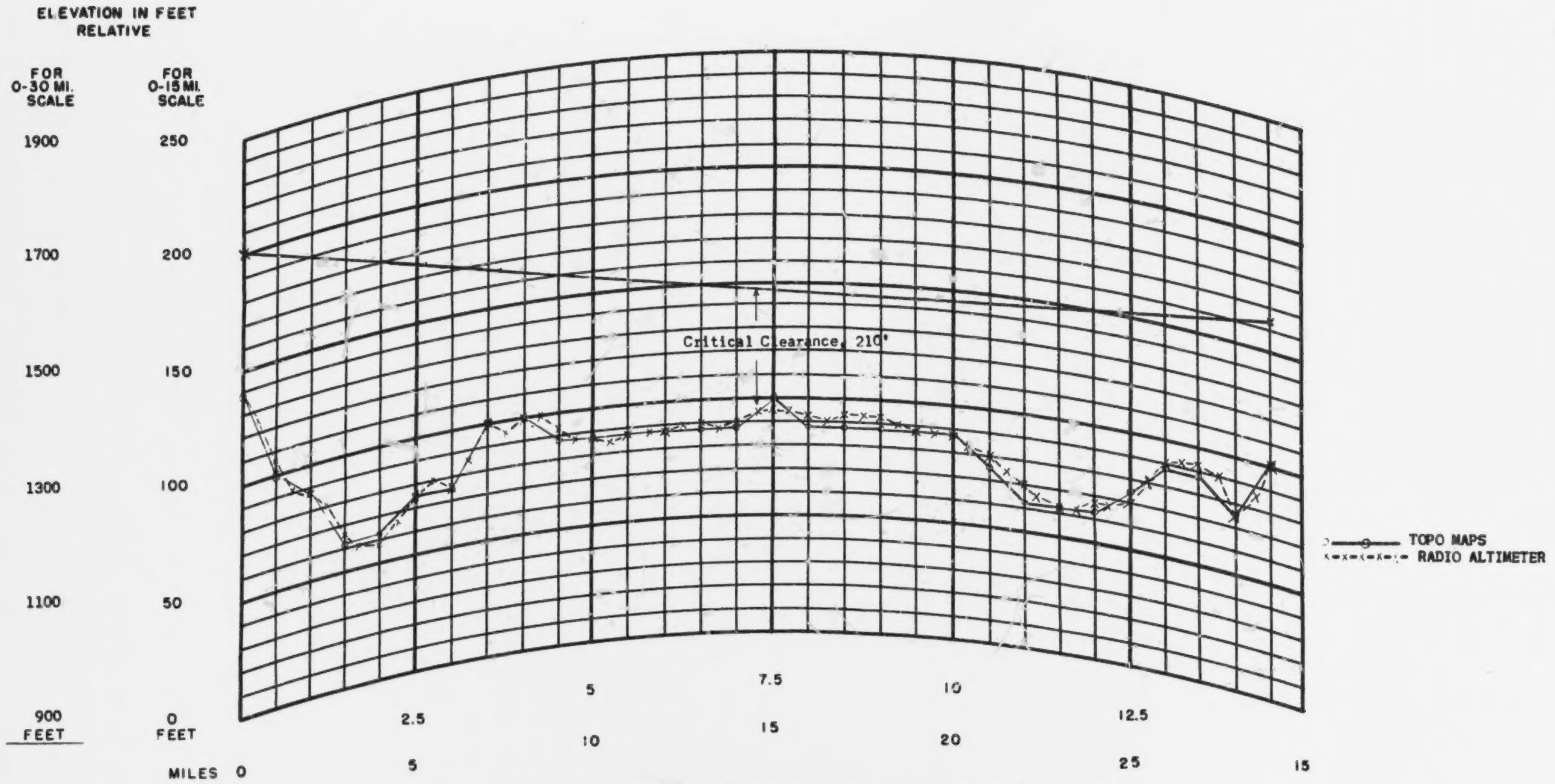
5.1 Description of Data Collected.

To date, some 44 individual topographical profile maps have been prepared for the purpose of studying transmission paths in the system. This work is continuing, and ultimately each of the microwave paths will be charted. For sake of a typical illustration, one of these maps is attached hereto and serves to represent the type of information which the final project report will provide. Topographical data presented on these maps is based upon information contained in U.S. Geological Survey Maps for the various geographic areas.

A second phase of the topographical study has just commenced. This consists of radio altimeter proof-checking each of the paths by means of aircraft flight, precisely along the actual transmission path. The K & M Beechcraft Bonanza has been equipped for this purpose by the installation of a military type APN-1 instrument which permits accuracy in the order of roughly 10 feet, since readings are taken only when barometric pressure conditions are consistent over relatively wide areas.

5.2 Sample Topographical Map. (Following Page).

5.3 Description of Topographical Supplement (Separate Report).



LOCATION	LATITUDE (N)			LONGITUDE (N)			CONTOUR MAPS USED	
	DEG.	MIN.	SEC.	DEG.	MIN.	SEC.	NAME OF MAP	REMARKS
Green Lake	45	16	50	94	53	40	Geological survey	
Benson	45	19	30	95	31	05	Geological survey	

TERMINAL DATA
NAME Green Lake
GROUND ELEV. 1450'
TOWER HEIGHT 250'

NOTE:
CLEARANCE IS THE DIFFERENCE OF ELEV. BETWEEN LINE OF SIGHT AND TOP OF TREES

CONTOUR PROFILE
FOR
MICROWAVE COMMUNICATIONS PATH

(STANDARD EARTH RADIUS)

HOP # 4
SCALE USED
0 - 30 Miles

TERMINAL DATA
NAME Benson
GROUND ELEV. 1[illegible]00'
TOWER HEIGHT 250'

SAMPLE TOPOGRAPHICAL MAP

Prepared by: K & M ELECTRONICS CO., Inc.
MINNEAPOLIS, MINNESOTA

PART VI

ACTIVATION OF UNUSED RESERVATIONS, ALLOCATION OF DROP-IN CHANNELS AND DISCUSSION OF EXISTING STATION FACTORS IN NAEB UPPER MIDWEST AREA

6.1 General Considerations.

The overall practicality of building a distribution network of the magnitude being considered will depend largely upon the number of participating stations along the various routes. Therefore, an intrinsic consideration of the entire project must be the activation of as many existing reserved VHF channels as possible on the main microwave loop and branch legs. In the six states comprising this study, there are at present 10 VHF reservations, only four of which are operating plus one UHF channel in operation at Madison, Wisconsin.

While existing VHF educational reservations in this region can satisfy the requirements for an interconnected microwave system, more VHF channels are needed to give each state local coverage over the greater part of its population. Additional VHF channels could be obtained in some areas by requesting that presently allocated VHF commercial channels be reserved for educational use. In some areas, new VHF channels could be added and reserved for educational use while maintaining proper channel separation. Information on such additional channels will be discussed on a channel by channel basis for each state.

By the addition of VHF channels to three of the states in the region, we have provided each state with its own group of stations which can be used as a separate state network. By making use of the dual service of the primary microwave network and the secondary service, this system can provide each state with its own network. In addition to the availability of its own network, each state can simultaneously participate in receiving or originating programs on the main network circuit.

Stations are designated as "Primary" or "Secondary" depending upon their location and function as part of a regional educational network. VHF station transmitting and studio equipment costs have also been separated into "Primary" and "Secondary" categories.

The Primary costs are those essential for each state for completion of the primary microwave loop and branch circuits. The primary stations must be built before the primary microwave system can be completed and operated as a regional network.

The Secondary costs are for those stations to which it is necessary to give more extensive service within each state, thus, functioning as part of a state network. These stations are not essential to the microwave regional network and may be built at a later date as demand requires or as funds become available.

Some of the stations in both Primary and Secondary groups, are "transmitter only" or satellite installations and are not equipped for origination of local programs. Satellite stations can rebroadcast only the programs received on the network or a local test pattern for maintenance.

The information on additional channel availability was supplied by Mr. Cy Braum of the J.C.E.T. It must be remembered that these additional channels could be requested for educational use. The availabilities may be changed by request for use by others, or by activation of channels in adjacent states which may affect the separation. If any of the unreserved channels are desired, immediate action should be taken. Any delayed action on requesting reservation of unused channels may require additional study on availability.

Ultra High Frequency channels are also available in numerous locations; however, these service points are not being considered in this study because of the present lack of general UHF interest in the area.

The following paragraphs provide a brief review of the present status as well as the participating requirements for each of the VHF reservations affected by this study. Cost estimates for the activation of all unused reservations provide for the construction of a maximum legal power station with a 500' supporting tower, unless otherwise noted, at each of these points. (Maximum legal power is 100 KW ERP for channels 2 - 6; 316 KW ERP for channels 7 - 13). It should be noted that studio video facilities at various key educational institutions vary widely and may have to be replaced or supplemented with equipment capable of producing maximum quality. The extensive network transmission system will, in order to be successful, require the utmost in picture quality at all originating points.

The channel by channel discussion notes each station as active or inactive which indicates stations presently on-the-air. There are three additional categories defining the FCC allocation of each station as follows:

"Reserved" indicates that this channel is listed in the FCC allocation table as being reserved for educational use.

"Commercial" indicates that this channel is allocated for commercial use. Commercial channels could be used for educational purposes and licensed by an educational organization for combined commercial and educational use. Commercial channels could be changed to an educational reservation by request and upon FCC approval.

"Drop-in" indicates that an additional VHF channel may be added by requesting the FCC to add the desired channel at a specific location. The drop-in channels noted have been recommended by Cy Braun of the J.C.E.T. and are presently available, subject to F.C.C. approval upon request.

6.2 State of Iowa - Channel by Channel Considerations.

6.2.1 General.

This state has two VHF reservations, one of which is active. There is also a commercial channel owned and operated by Iowa State University. No additional channels will be available in the foreseeable future. All of the Iowa stations are primary stations located on the main microwave loop and thus would be major users of and contributors to an educational network.

6.2.2 Ames - WOI-TV, Channel # 5 (Active, Commercial).

This station is operated by the Iowa State University and is fully equipped for full power operation as well as for local and remote programming. Although WOI-TV operates on a commercial channel assignment, its ownership and educational service policy strongly suggest that it be considered as a part of this study. The Iowa State University has had a dominant role in the entire development of educational television over and above its activities in commercial telecasting.

6.2.3 Des Moines, KDPS-TV, Channel # 11 (Active, Reserved).

This station is licensed to the Des Moines Public School

System and is not as fully equipped a station as would be desired for active network origination. The station presently uses vidicon cameras in conjunction with a low powered transmitter on a small tower. The transmitting site could be moved to a point west of Des Moines near Dallas Center in order to reduce overlap in coverage with Iowa City. The Sioux Falls channel 11 assignment limits the distance that this site may be moved.

6.2.4 Iowa City - ( ) Channel # 12 (Inactive, Reserved).

Presumably the State University of Iowa would operate this station. The University has well equipped studio facilities and would need only a transmitting plant to become operational.

6.3 State of Minnesota - Channel by Channel Considerations.

6.3.1 General.

Three VHF educational reservations are available with one of them on the air. There are no additional VHF channels available as a drop-in and no unused commercial channels in the uncovered areas.

6.3.2 Appleton - ( ) Channel # 10 (Inactive, Reserved).

This station is located on the main microwave loop. Since there is no major educational institution in the immediate area, it is recommended that this station be equipped as a satellite station. Its location is desirable for providing service to the presently uncovered area of western Minnesota. This site is a connection point to the North Dakota branch leg of the microwave system. At present no equipment or other facilities exist at this point; therefore, a complete transmitting station (less studio apparatus) should be planned.

6.3.3 Duluth-Superior - ( ) Channel # 8 (Inactive, Reserved).

Duluth-Superior Area Educational TV Corporation is a public corporation which has been formed to act as the licensee of the reserved channel at Duluth and is engaged in fund raising and other organizational matters. The presence of the Duluth branch of the University of Minnesota at this point will provide an excellent source of program resources for the projected station. The microwave installation proposed for this location provides for a branch leg with two-way service connections into the network at Minneapolis-St. Paul.

6.3.4 Minneapolis-St. Paul - KTCA-TV, Channel # 2 (Active Reserved).

This station can be considered to be adequately equipped to meet the minimum requirements for local originations as well as the remote pickup of programs to be fed to the network.

6.4 State of Nebraska - Channel by Channel Considerations.

6.4.1 General.

Only one reserved educational channel is assigned to the state; this channel is located at Lincoln and is activated by the University of Nebraska. Two drop-in channels could be added, as indicated, to give better coverage of the state. Due to lack of channel availabilities, there is no provision for service to the extreme western part of Nebraska.

6.4.2 Ainsworth - ( ) Channel # 3 (Inactive, Drop-in).

This channel would be serving a very sparsely populated section of the state but would help to give greater overall state coverage. This would be a "transmitter only" operation fed by a single direction off-the-air microwave from Lincoln through the Lexington station.

6.4.3 Lexington - (   ) Channel # 4 (Inactive, Drop-in).

This station would be a "drop-in" which would have to maintain its separation from channel 5 in Hastings and may also be affected by additional allocations in Kansas. This channel would serve a greater population than the Ainsworth channel and would be more important in extending the state coverage. With no educational institution in the area, this channel is proposed as a "transmitter only" operation which is fed by a single direction off-the-air microwave from Lincoln.

6.4.4 Lincoln - KUON-TV, Channel # 12 (Active, Reserved).

This station is an active reserved channel operated by the University of Nebraska. KUON-TV is planning to move their transmitter site to Wahoo, Nebraska and proposes to install a 1,000' tower with full power to give good service to both Lincoln and Omaha. This report shows the additional cost for transmitter facilities and tower at the new location. The station is well equipped and has a STL.

6.5 State of North Dakota - Channel by Channel Considerations.

6.5.1 General.

This state has two VHF reservations and we have shown four additional channels that could be requested which would give extensive coverage to the state. Because of its location in the region and its concentrated eastern population distribution, only two of the stations are joined to the primary microwave loop through a branch leg from Appleton, Minnesota. The rest of the state would have distribution of the network signals but would not be depended upon for local originations.

6.5.2 Bismarck - ( ) Channel # 3 (Inactive, Drop-in).

Bismarck has only a Junior College; however, it has the prominence of being the state capitol. This station would be a "transmitter only" type, fed from Fargo by off-the-air pickup and single direction microwave system.

6.5.3 Dickinson - ( ) Channel # 4 (Inactive, Commercial).

This is a commercial channel which would have to be reserved by petition for educational use. Dickinson has a State Teachers College. However, it is doubtful that they would originate local programs so this station is also considered a satellite having "transmitter only" fed from Bismarck by off-the-air pickup and through a single direction microwave.

6.5.4 Fargo - ( ) Channel # 13 (Inactive, Drop-in).

It is understood that a petition is being prepared requesting reservation of this channel. North Dakota Agricultural College is located at Fargo and could be a major contributor to the network. Both transmitter and studio equipment are proposed since this station will be on a main microwave leg allowing its programs to be fed in each direction.

6.5.5 Grand Forks - ( ) Channel # 2 (Inactive Reserved).

It is proposed that a fully equipped station will be established at this point for local program origination, presumably by the University of North Dakota. The recommended transmitting site is located twenty miles northwest of Grand Forks in order to reduce overlap with Fargo. This station will give substantial service into heavily populated Red River Valley areas of both Minnesota and North Dakota

6.5.6 Minot - ( ) Channel # 6 (Inactive, Reserved).

There is only a small State Teachers College at Minot which would not be considered for local live originations on the network, thus, a "transmitter only" operation is proposed for this location. This station would be fed from an off-the-air pickup through a single direction microwave from Grand Forks.

6.5.7 Williston - ( ) Channel # 11 (Inactive, Commercial).

This is a channel that could be petitioned for educational use. Since there is no educational institutions in this area, it is proposed that this channel take signals off-the-air from Minot and then go through a single direction microwave. This would be operated as a satellite, thus having only a transmitting plant.

6.6 State of South Dakota - Channel by Channel Considerations.

6.6.1 General.

There are two VHF educational reservations for South Dakota; however, by requesting three additional channels, very extensive coverage could be provided for the state as provided in North Dakota.

6.6.2 Aberdeen - ( ) Channel # 2 (Inactive, Drop-in).

This station would have to be located northwest of Aberdeen to maintain separation from channel 3 at Garden City and channel 2 at Vermillion. Aberdeen has a State Teachers College; however, it is not expected that they would originate local programs for some time. Therefore, a "transmitter only" satellite operation is proposed for this channel. This station would be serviced by an off-the-air pickup of Vermillion and then through a single direction microwave.

6.6.3 Brookings - (   ) Channel # 8 (Inactive, Reserved).

If channel 2 of Vermillion is relocated, (see Vermillion) the Brookings area could be adequately served by this single station. Studio equipment and STL should be provided for the South Dakota State College at Brookings since they would be considered a major participant in supplying programs to the network and supplying local service through channel 2. If channel 2 is not moved to the proposed location, Brookings should be reconsidered as a separate operation.

6.6.4 Pierre - (   ) Channel # 10 (Inactive, Commercial).

This channel could be petitioned to be reserved for education but would not serve any particular educational institution. It would help to provide greater state coverage and would be a "transmitter only" operation fed by an off-the-air pickup from Vermillion, then through a single direction microwave.

6.6.5 Rapid City - (   ) Channel # 11 (Inactive, Drop-in).

While Rapid City is remotely located from the main microwave loop, it is a community which has had very rapid growth. A large air base located at Rapid City helps to make it one of the larger populated areas of the state. The South Dakota School of Mines is located in Rapid City but because of its remoteness, this station is planned as a "transmitter only" operation and if constructed, would be fed by an off-the-air single direction microwave system from Pierre.

6.6.6 Vermillion - (   ) Channel # 2 (Inactive, Reserved).

The University of South Dakota has recently applied for a construction permit to build a low powered station on the campus at Vermillion. There is interest in the state to move this desirable channel further north to a point approximately forty miles west of Sioux Falls installing a 1,000' tower. This single station would serve a great percentage of the state population, including Vermillion, Brookings, and Sioux Falls, thus allowing the educational units of each to feed programs directly to the tower. Vermillion and Brookings could be connected to the station through the main microwave loop. It is proposed that this station be fully equipped and located near Freeman South Dakota. It would also provide service to Sioux City, Iowa.

6.7 State of Wisconsin - Channel by Channel Considerations.

6.7.1 General.

This state has one VHF and several UHF reservations, two of which are active. The inactive UHF reservations have not been considered in this report; however, it may be necessary to use these UHF reservations as a means of serving the entire state. There are no unused VHF commercial channels and no possibility of adding drop-in channels due to the complete use of all available VHF allocations.

6.7.2 Madison - WHA-TV, Channel # 21 (Active, Reserved).

The University of Wisconsin is the licensee of this station which is the only UHF station considered in this report. The

University has been very active in both educational radio and television and presumably would be a major contributor to the educational network. Madison is a network junction where eastern educational circuits, stratovision, or other area networks could join the Upper Midwest. WHA-TV has a well equipped studio with a low powered transmitter radiating from a small tower. While the UHF coverage is limited, it may not be economically possible to increase coverage by improving the transmitter equipment and tower height. Additional funds have not been shown in this report as further study seems inevitable.

6.7.3 Milwaukee - WMV[illegible]-TV, Channel # 10, (Active, Reserved).

The Board of Vocational and Adult Education is the licensee of this channel which has a very complete television facility. WMVS provides service to a very heavily populated area and would presumably be a very active participant in the network operation. This station would require no additional funds under this study.

6.8 VHF Transmitting and Studio Equipment Costs.

6.8.1 General Considerations.

The station equipment costs are full list price using a typical station equipment list and do not include the usual 10% educational discount. The transmitter and studio costs include an estimate for buildings and land for each.

Satellite stations having a "transmitter only" operation, are equipped with a minimum of video and audio equipment for the origination of test pattern and for audio test or local announcements.

The studio equipment consists of two image orthicon cameras and a vidicon film chain with switching equipment and accessories.

A magnetic tape recorder should now be considered as an essential part of studio equipment; however, it has not been included since it will probably be furnished through other funds similar to the donation received by existing educational stations.

6.8.2 State by State Summary of Studio and Transmitter Cost.

	Primary Cost	Secondary* Cost
Iowa	$ 635,470.	$
Minnesota	579,564.	
Nebraska	311,320.	477,800.
North Dakota	746,270.	968,120.
South Dakota	545,440.	741,740.
Wisconsin (No additional cost)		
Total	$ 2,818,064	$ 2,187,660

* Secondary Cost includes the cost of the transmitting equipment for the stations which are not necessary for operation of the Primary Microwave Network. These stations would function as part of a state network to extend coverage throughout each state.

6.8.3 State of Iowa Capital Cost.

		Primary Cost	Secondary Cost
Ames, Iowa, Channel 5			
No additional cost required			
Des Moines, Iowa, Channel 11 (This total may be reduced by use of equipment presently available).			
Transmitter Station	246,320		
Studio	123,320		
STL	19,510		
		$ 389,150	
Iowa City, Iowa, Channel 12			
Transmitter Station	246,320	246,320	
Total		$ 635,470	

6.8.4 State of Minnesota Capital Cost.

		Primary Cost	Secondary Cost
Appleton, Minnesota, Channel 10			
Transmitter Station	$ 246,320		
Satellite Video and Audio Equipment	5,100		
		$ 251,420	
Duluth, Minnesota, Channel 8			
Transmitter Station (Less tower, building and land)	185,314		
Studio	123,320		
STL	19,510		
		$ 328,144	
St. Paul, Minnesota, Channel 2			
No additional equipment required			
Total		$ 579,564	

6.8.5 State of Nebraska Capital Cost.

		Primary Cost	Secondary Cost
Ainsworth, Neb., Channel 3			
Transmitter Station	$ 233,800		
Satellite Video & Audio	5,100		
			$ 238,900
Lexington, Neb., Channel 4			
Transmitter Station	233,800		
Satellite Video & Audio	5,100		
			238,900
Lincoln, Neb., Channel 12			
Transmitter Station (With 1000' Tower)	311,320	$ 311,320	
	Total	$ 311,320	$ 477,800

6.8.6 State of North Dakota Capital Cost.

Bismarck, N.D. Channel 3			
Transmitter Station	$ 233,800		
Satellite Video & Audio	5,100		
			238,900
Dickinson, N.D. Channel 4			
Transmitter Station	233,800		
Satellite Video & Audio	5,100		
			238,900
Fargo, N.D. Channel 13			
Transmitter Station	246,320		
Studio	123,320		
		369,640	
Grand Forks, N.D. Channel 2			
Transmitter Station	233,800		
Studio	123,320		
STL	19,510		
		376,630	

		Primary Cost	Secondary Cost
Minot, N.D. Channel 6			
Transmitter Station	$ 233,800		
Satellite Video & Audio	5,100		
			$ 238,900
Williston, N.D. Channel 11			
Transmitter Station	246,320		
Satellite Video & Audio	5,100		
			251,420
North Dakota Total		$ 746,270	$ 968,120

6.8.7 State of South Dakota Capital Cost.

Aberdeen, S.D. Channel 2			
Transmitter Station	$ 233,800		
Satellite Video & Audio	5,100		
			238,900
Brookings, S.D.			
Studio	123,320		
		123,320	
Pierre, S.D. Channel 10			
Transmitter Station	246,320		
Satellite Video & Audio	5,100		
			251,420
Rapid City, S.D. Channel 11			
Transmitter Station	246,320		
Satellite Video & Audio	5,100		
			251,420
Vermillion, S.D. Channel 2			
Transmitter Station (With 1000' Tower)	298,800		
Studio Site	123,320		
		422,120	
Total		$ 545,440	$ 741,740

6.8.8 State of Wisconsin Capital Cost.

No Cost Included.

6.8.9 Capital Transmitting Station Cost Study Summary.

High Band transmitter station		
Equipment and Tower, Schedule A	$ 225,320	
Building, 30' x 50'	18,000	
Land	3,000	
		$ 246,320
Low Band transmitter station		
Equipment and tower, Schedule B	212,800	
Building, 30' x 50'	18,000	
Land	3,000	
		233,800
Studio Site		
Equipment, Schedule C	81,320	
Building 50' x 70'	42,000	
		123,320
Studio to Transmitter Link, Schedule D		19,510
Satellite Video and Audio Equipment, Schedule E		5,100

To substitute 1,000' tower, add $65,000

6.8.10 Transmitter Equipment, High Band, 316 KW ERP.

SCHEDULE A

1	25 KW Transmitter		$ 105,000.00
1	Set 100% Spare Tubes		5,180.00
1	4 Bay Alford Antenna		33,600.00
1	Antenna Mast		5,000.00
1	Set of Deicers for Antenna		2,400.00
1	Diplexing Filter		9,500.00
1	Guyed Tower, 500' installed		35,000.00
1	Set of Transmission Line & Accessories		5,610.00
2	Harmonic Filters	$1,000	2,000.00
1	Color Notch Filter		1,000.00
1	R.F. Load and Wattmeter		3,385.00
1	Frequency and Modulation Monitor, including F.C.C. Spare Tubes		2,050.00
1	Control Console, with Master Monitor		5,700.00
1	Demodulator		1,925.00
1	Side Band Analizer		2,190.00
1	Oscilloscope		1,200.00
1	Tube Tester and Test Meter		280.00
1	Noise and Distortion Meter		650.00
1	Audio Oscillator		500.00
2	Rack Cabinets	75	150.00
1	Set of Audio Control and Monitoring Equipment		500.00
	Transmitter installation and accessories		2,500.00
			225,320.00

To substitute 1,000' Tower, add $65,000

6.8.11 Transmitter Equipment, Low Band, 100 KW ERP.

SCHEDULE B

1	25 KW Transmitter		$ 105,000.00
1	Set 100% Spare tubes		5,180.00
1	6 Bay Super Turnstile Antenna		30,750.00
1	Set of Antenna Deicers		2,100.00
1	Diplexer, 25 KW		1,150.00
1	Color Notch Filter		1,000.00
2	Harmonic Filters	$1,000	2,000.00
1	Set of Transmission Line		9,590.00
1	Guyed Tower, 500', Installed		35,000.00
1	R.F. Load and Wattmeter		3,385.00
1	Frequency and Modulation Monitor, including F.C.C. Spare Tubes		2,050.00
1	Control Console with Master Monitor		5,700.00
1	Demodulator		1,925.00
1	Side Band Analizer		2,190.00
1	Oscilloscope		1,200.00
1	Tube Tester and Test Meter		280.00
1	Noise and Distortion Meter		650.00
1	Audio Oscillator		500.00
2	Rack Cabinets	$ 75	150.00
1	Set of Audio Control & Monitoring Equipment		500.00
	Transmitter installation and Accessories		2,500.00
			212,800.00

To substitute a 1,000' Tower, add $65,000.

6.8.12 Studio Equipment.

SCHEDULE C

2	Image Orthicon Studio Cameras complete with cables, lens, & accessories	$15,700	$ 31,400.00
2	Tripods	275	550.00
2	Dollies	325	650.00
2	Friction Heads	475	950.00
1	Video Switcher		950.00
1	Master Monitor		2,450.00
1	Master Power Supply with Regulators		2,000.00
1	Video Distribution Amplifier		290.00
1	Pulse Distribution Amplifier		270.00
1	Vidicon Film Camera Chain		4,825.00
2	16 mm Television Film Projectors	7,500	15,000.00
1	Multiplexer		1,550.00
1	Dual Slide Projector		2,750.00
10	Utility Monitors	215	2,150.00
4	Rack Cabinets	75	300.00
1	Stabilizing Amplifier		1,200.00
1	Set of Studio Lighting Equipment		6,535.00
1	Set of Audio Equipment with Console		2,500.00
	Miscellaneous Studio Equipment & Spare Parts		2,500.00
	Studio equipment installation		2,500.00
			$ 81,320.00

6.8.13 Studio to Transmitter Link (STL Microwave).

SCHEDULE D

1	1.0 Watt STL Microwave		$10,000.00
2	8' x 12' Passive Reflectors	$ 545	1,090.00
2	6' Parabolic Antennas	300	600.00
2	Antenna Feed Horns	175	350.00
2	Horizontal Mounts	60	120.00
2	Parabolic Heaters	125	250.00
1	Sound Channel		1,200.00
1	Set Waveguide Accessories		400.00
1	250' Guyed Tower		5,500.00
			$ 19,510.00

6.8.14 Satellite Video and Audio Equipment.

SCHEDULE E

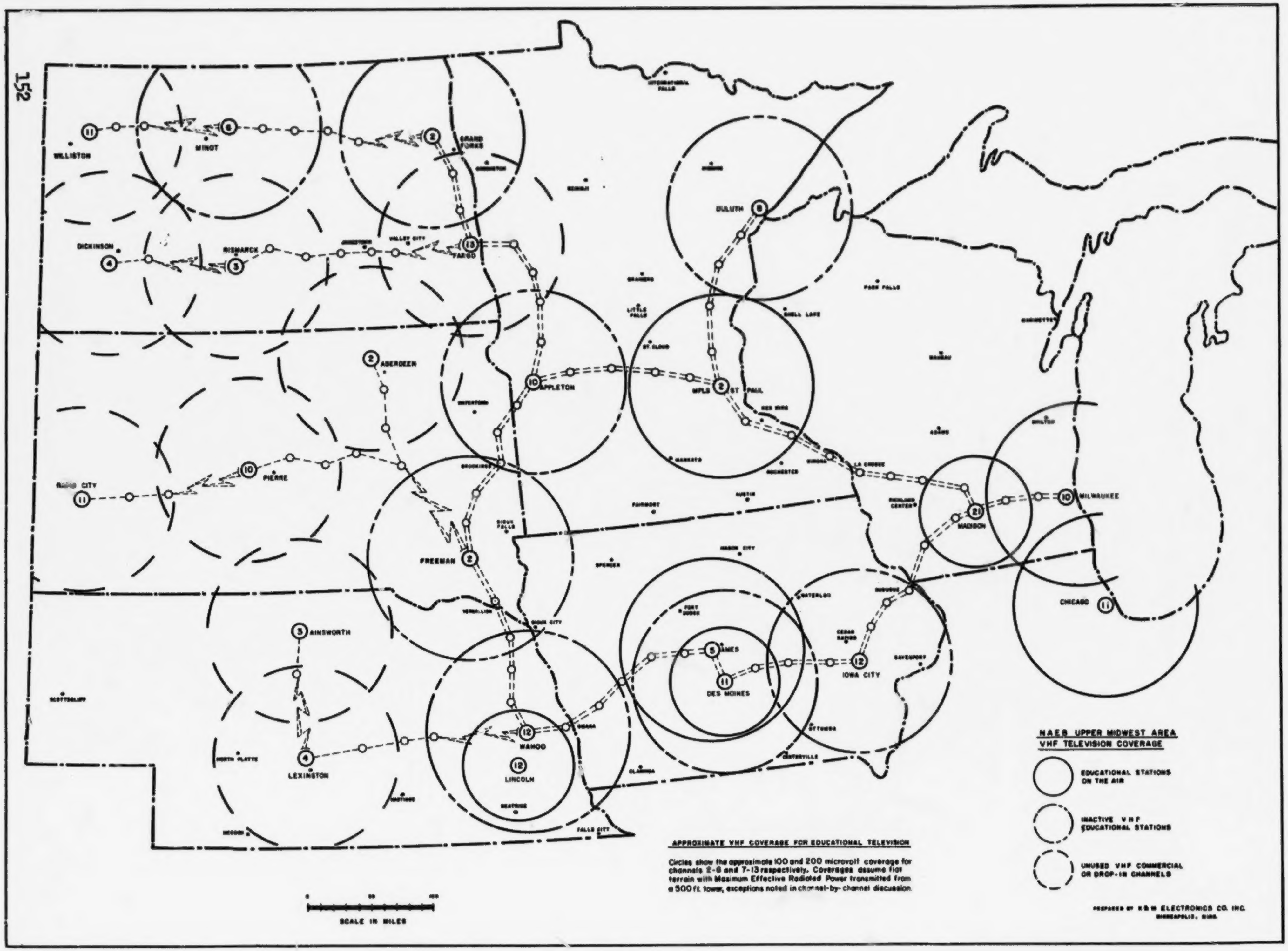
1	Sync Generator with Power Supply	$ 1,850.00
1	Monoscope	3,000.00
1	Audio Remote Amp with Microphone	250.00
		$ 5,100.00

6.9 Information on the Map of the NAEB Upper Midwest Area VHF Television Coverage.

The VHF coverage map shows three categories of stations; the educational stations on the air, the inactive reserved educational stations, and the unused commercial or drop-in channels.

The coverage shown is 100 microvolts per meter on channels 2 - 6, and 200 microvolts per meter on channels 7 - 13. Coverages assume flat terrain with maximum Effective Radiated Power transmitted from a 500' tower except where coverage differs due to existing conditions or by information on proposed changes which are noted in the channel-by-channel section.

6.9.1 NAEB Upper Midwest Area VHF Television Coverage Map. (Following Page).


WILLISTON
11
MINOT
6
GRAND FORKS
2
DICKINSON
4
BISMARCK
3
VALLEY CITY
FARGO
13
INTERNATIONAL FALLS
DULUTH
8
BRAINERD
LITTLE FALLS
ST CLOUD
MPLS
ST PAUL
2
RED WING
PARK FALLS
SHELL LAKE
MARINETTE
WAUSAU
ADAMS
ABERDEEN
2
APPLETON
10
WATERTOWN
PIERRE
10
RAPID CITY
11
BROOKINGS
MANKATO
ROCHESTER
LA CROSSE
AUSTIN
FAIRMONT
RICHLAND CENTER
MADISON
21
MILWAUKEE
10
SIOUX FALLS
FREEMAN
2
MASON CITY
SPENCER
VERMILLION
SIOUX CITY
FORT DODGE
AMES
5
DES MOINES
11
WATERLOO
CEDAR RAPIDS
IOWA CITY
12
DUBUQUE
DAVENPORT
CHICAGO
11
AINSWORTH
3
SCOTTSBLUFF
NORTH PLATTE
LEXINGTON
4
WAHOO
12
OMAHA
LINCOLN
12
HASTINGS
BEATRICE
McCOOK
FALLS CITY
CLARINDA
OTTUMWA
CENTERVILLE
EDUCATIONAL STATIONS ON THE AIR
INACTIVE V H F EDUCATIONAL STATIONS
UNUSED VHF COMMERCIAL OR DROP-IN CHANNELS
0
50
100
SCALE IN MILES

NAEB UPPER MIDWEST AREA
VHF TELEVISION COVERAGE

APPROXIMATE VHF COVERAGE FOR EDUCATIONAL TELEVISION

Circles show the approximate 100 and 200 microvolt coverage for channels 2-6 and 7-13 respectively. Coverages assume flat terrain with Maximum Effective Radiated Power transmitted from a 500 ft. tower, exceptions noted in channel-by-channel discussion.

PREPARED BY K & M ELECTRONICS CO. INC.
MINNEAPOLIS, MINN.

PART VII

STUDY OF SECONDARY SERVICE POSSIBILITIES

7.1 Closed Circuit Services for Non-Broadcast Educational Purposes.

In areas where kinescope recorders have been operated by educational television stations there has been considerable use of these machines in recording material not specifically intended for broadcast.

Sometimes this material takes the form of classroom lectures recorded for ultimate projection in an audio-visual program as distinguished from classroom television. At other times, material may be of a strictly research nature for the preservation of data in the same sense as motion pictures are used in the fields of medicine or other technology.

The regulatory rules governing the licensing of television remote pickup circuits and similar allocations of broadcast microwave, do not specifically permit the use of such circuits for the transmission of video information which does not have ultimate broadcast usage. Interpretation of this point is essentially subject to a rather liberal range since it is difficult to ascertain what material might subsequently be selected for broadcast. In other words, intent concerning the end usage of a recorded program sometimes rationalizes the legal use of broadcast microwave circuits for diverse applications so long as the material has potential broadcast value.

Needless to say, this interpretation can be carried too far and future use of these channels to serve the many conceivable needs of a closed circuit nature would trespass on the intent specified in the Federal Communications Commissions Rules. Accordingly, if a projected microwave system is to be constructed to serve supplementary television activities over and above those of a strictly broadcast nature, a common carrier type of frequency allocation and license structure should be sought. This form of license does not distinguish between closed circuit and broadcast service and would be consistent with actual usage.

The ultimate need for transmitting color through network circuits also has implications in closed circuit service. There are already numerous medical centers throughout the country which utilize color television as a basic teaching tool. These centers, usually located at major colleges and universities, would very likely be the first to solicit color transmission through a network, should it be made available for closed circuit purposes.

7.2 Service to Supplementary Satellite Stations for Extension of Coverage.

While VHF station assignments give potential coverage to most of the heavily populated regions, there is still a considerable amount of uncovered area in the Upper Midwest which should have some future plans. There are various means by which television service may be extended to these areas. Particular concern should be given to extending service to points where there are key educational institutions.

In general, the microwave system was planned so that a microwave site is close to such towns as Winona, Minnesota; LaCrosse, Wisconsin; Dubuque and Grinnell, Iowa; all of which have important college institutions which could make definite use of the educational programs. In the future some of these colleges may become technically capable of originating programs and become valuable participants in the educational network. Local program origination from these communities could be facilitated due to the location of the microwave sites nearby.

7.3 Service to Translator Stations.

At present the Upper Midwest Area has many UHF and VHF translators rebroadcasting commercial programs, providing service to shadowed and distant areas. Major communities such as Bemidji, International Falls, Olivia, Redwood Falls and St. James, Minnesota, and Spencer, Iowa, have UHF translator systems serving over 30,000 homes, or more than 100,000 people. The Redwood Falls translator system rebroadcasts the four Minneapolis commercial channels as well as KTCA-TV, the educational channel. Educational channels can be added to any of the indicated translator systems, thus extending coverage to areas which would probably never be reached due to lack of VHF channel allocations, lack of funds, or too sparse a population to warrant direct service. All of the UHF translators in this area are built and owned by local non-profit organizations and operated on donations.

The FCC rules allow UHF translators to rebroadcast the entire program schedule of the received station and do not permit local originations at the translator. Recently the F.C.C. issued a temporary construction permit for testing of local origination of educational programs on two UHF translators at Salt Lake City, Utah. These permits were issued to the licensee of a VHF educational television station. Local origination of educational programs on UHF translators will now allow present educational stations to broadcast several different programs simultaneously, thus providing service to meet various requirements.

Local origination on translators means operation under relaxed rules, thus reducing initial equipment and operating costs. Reduced costs may allow many educational institutions to broadcast in their local areas, thus extending educational service. Through the economics of UHF translators, broadcasting can now be considered for almost any level including education for the handicapped, vocational training, night school, high school, college or other special teaching.

Nebraska, North Dakota and South Dakota have numerous VHF boosters in operation extending coverage of commercial station to sparsely populated areas. While the VHF booster systems are not F.C.C. approved, indications are that they will be legalized. When approved, VHF boosters could be considered as a means of extending coverage in the Upper Midwest Area.

7.4 Service to Community Antenna Television Systems (CATV).

Extension of television service to outlying areas has been effected in recent years by privately owned antenna systems. Service by these systems has been on a monthly fee basis whereby the customer pays a certain amount per month to have television signals brought to his home by means of a coaxial cable. Some of the CATV systems include educational channels; however, many of them are capable of handling only five channels, thus requiring time sharing between educational and commercial channels.

Most CATV communities provide coaxial cable service to the schools and coaxial connections between schools thus allowing their programs to be distributed among the schools and also to homes connected to the system.

Complete information on the number of connections and the channels carried is not available. Major CATV systems operating in this region are:

Iowa

Dubuque
Estherville
Fort Madison

Minnesota

Brainerd
Fairmont
International Falls
Jackson
Mankato
New Ulm
Rochester
Willmar

Nebraska

Alliance
Falls City
Kimball
Sydney

South Dakota

Lead
Mitchell
Rapid City

Wisconsin

Niagara
Rhinelander
Rice Lake
Wausau

7.5 Audio Carrier Services to Educational Radio Stations.

Some interest has been expressed by operators of educational radio stations as to the feasibility of including network audio services to these valuable outlets in conjunction with video service to educational television stations. From a technical standpoint, this is a real possibility. Although it is our understanding that federal funds are not earmarked for grants-in-aid to implement this type of service, there are still many desirable possibilities which should be explored along with television circuit study.

Possibilities for including educational radio in a projected television microwave system might be explored along the following lines:

A. Investigation of F.C.C. Rules and Regulations governing Common Carrier Television frequency assignments concerning the possible inclusion of audio subcarrier assignments for service to non-television users.

B. Investigation of F.C.C. Rules and Regulations governing STL frequency assignments concerning the possible inclusion of audio subcarrier assignments for service to non-television users.

C. Investigation of costs and allocation factors for a separately licensed audio information bearing network utilizing and sharing identical sites, towers, and other useable features of a projected television network.

From a strictly technical point of view, the coordination of supplementary audio sub-carriers into video microwave apparatus should not be too difficult. However, it is likely that supplementary apparatus required to provide this service could not be financed through federal funds unless re-interpretation of the law is secured. Furthermore, the various allocation factors involved would have to be explored with the Federal Communications Commission.

PART VIII

STUDY OF POSSIBLE ALTERNATIVES TO PRIVATE EDUCATIONAL MICROWAVE NETWORK

8.1 The Role of Television Tape Recording.

Since the project undertaken in connection with the feasibility of a privately operated educational microwave network is general in nature, it should logically include some analysis as to whether such a microwave network is necessary. At present there are available to broadcasters, new electronic tools which were not in existence when educators first considered the desirability of linking stations by direct circuits.

An example of these tools is the magnetic television recorder which can be used to syndicate high quality programs at a reasonable cost. Since it is the nature of a great deal of educational material that it need not be transmitted to the public at identical times throughout a wide portion of the country, we must look for a different justification for linking stations through transmission circuits. In fact, diversity in the presentation time of exchange programs actually works to the advantage of the station since it permits it to schedule local live programs more effectively when little or no time flexibility is possible because of local school schedules and other factors.

Through the use of a magnetic recorder, each station could record and store a complete course for use during the following term. The cost of tapes for recording a complete course for later use would undoubtedly be excessively high, thus requiring other means of distribution. It is estimated that each course recorded would require 48 half-hour programs at a cost of approximately

$7,000 for magnetic tapes excluding production, recording, and all other costs. It would require two sets of tapes, or $14,000, using one for playback while instructing, and the second set for recording the course to be used for the following term. At $14,000 per course for each station, it is obvious that storing huge quantities of information is prohibited by tape cost.

Should an independent educational network be built, it would, in all likelihood, be used extensively for the purpose of shuttling pre-recorded material to other points where the programs would again be recorded for later release. In other words, it would serve in lieu of actually transporting tape from a duplication center.

This together with the enrichment and spontaneity which segments of live and timely program material provide, would make a network medium extremely valuable. The microwave circuits will very likely carry ever increasing quantities of recorded material, thus integrating the magnetic tape recorder and the microwave network into an economically feasible distribution system.

At present we have inquiries out among the commercial television networks soliciting information to the extent of which television tape may have permitted reductions in circuit-mile-hours of microwave or cable procurements. This may serve as a guide to the entire future of circuit transmission versus syndication of recorded programs.

The Columbia Broadcasting System Television Network which makes vast use of television magnetic recording facilities in its operation, has not seen fit to reduce its circuit-mile-hours of microwave or cable usage. This is an indication that the commercial networks are continuing to use microwave and cable facilities as their principal means of serving the public.

It appears that tape will become an almost mandatory adjunct to network facilities if users are to realize the ultimate in service from a projected microwave network in addition to its use as a valuable syndicated medium.

8.2 Comparative Cost of AT&T Services.

8.2.1 Early Studies.

In 1952, the Northwestern Bell Telephone Company prepared rather extensive estimates for providing service to a number of projected educational stations in Minnesota, operating out of a Twin Cities central station. While the network as envisaged at that time involves a totally different layout than that proposed in this report, the circuit mile costs that are shown are essentially the same as those which would be encountered today.

Essential points concerning this early plan were outlined in a letter from L. S. Craswell who was the Director of Northwestern Bell's Commercial Department at that time. The following is a copy of Mr. Craswell's letter:

NORTHWESTERN BELL TELEPHONE COMPANY

Minneapolis, Minnesota
November 6, 1952

Mr. Berten A. Holmberg
Mr. Burton Paulu

In accordance with our discussion of October 23, we are pleased to quote you our charges for one video channel for your use up to 8 consecutive hours per day, and one Schedule "A" audio channel up to 16 consecutive hours per day, tying together your studio location in the Twin Cities with your outlying transmitter locations as follows:

				Basic Termination Chg.	
Connecting	Pricing Mileage	Video and Audio Per Month	Non-Recurring	Total Amount	Reducing each mo.
Mpls. - Duluth	139	7,713.00	45.00	None	
Add Brainerd	70	3,792.00	22.50	19,000.00	1/120th
Add T.R. Falls	154	7,236.00	22.50	94,000.00	1/120th
Add Det. Lakes	23	1,865.00	22.50	19,000.00	1/120th
Add Marshall	130	6,252.00	22.50	159,000.00	1/120th
Add Rochester	78	4,120.00	22.50	19,000.00	1/120th
Add Morris	35	2,357.00	22.50	51,000.00	1/120th
Add Mankato	52	3,054.00	22.50	94,000.00	1/120th
Add Hibbing	63	3,505.00	22.50	79,000.00	1/120th

The foregoing quotations are approximate to the extent that they contemplate local channels in the Twin Cities not to exceed four airline miles from our principal central office and at each of the other points not to exceed two airline miles. However, changes in such measurements would only have a minor effect on the totals.

We desire to point out also, that changes in the order of adding the various locations involved would change the individual pricing somewhat although the totals shown for all ten stations would of course remain the same.

Fred Hird and I have appreciated the opportunity to discuss this matter with you and shall be very glad to discuss the matter further to any extent desired with you or your committees and we shall be deeply appreciative of the opportunity to serve you.

L. S. Craswell

It will be noted that the plan covered in Mr. Craswell's letter involved 744 circuit miles with monthly charges totaling $39,894.00. If the service arrangements were to be maintained for a period of 10 years (120 months) no portion of the termination charges shown would become due. However, if service were to be discontinued at a time less than 10 years from its inception, the remaining prorated portion of the termination charge would become due.

The basic termination charge covers, in part, the capital liability incurred by the carrier in behalf of the user in establishing circuits over new routes which have no other immediate revenue possibilities.

Note that the 1952 estimate covers only one way circuits to each of the several cities. This would preclude program origination at the outlying points unless second circuits were installed.

In order to ascertain the applicability of the 1952 Northwestern Bell estimate, contact was established with Mr. Newhouse who is presently in charge of the company's Commercial Department.

Mr. Newhouse indicates that there have been no significant changes in the basic AT&T formula, and that for our purposes, the earlier figures are sufficiently accurate. He indicates however, that the basic termination charge calculations are now usually based on a 36 month minimum. Furthermore, the extent of construction which has occurred since 1952 may reduce the actual need for basic termination charges over portions of routes which may be involved.

8.2.2 Sample Estimate.

Since there has been little change in basic rates, we have used the rates quoted in Mr. Craswell's 1952 letter to determine a total system monthly charge.

Bi-directional program service between St. Paul-Minneapolis and Duluth, based on the existing AT&T formula, would cost in excess of $15,420.00 per month. The video service period is as outlined in Mr. Craswell's letter--Section 8.2.1 (i.e. any 8 consecutive hours per day, 7 days per week).

Since the Twin Cities-Duluth leg represents approximately 8% of the primary network system being studied herein, the complete system would incur an estimated monthly charge of $193,000 or an annual charge of $2,300,000.00 if obtained through existing AT&T carrier services.

While the AT&T approach would provide the ultimate in quality and reliability, there remains the fact that many commercial broadcasters have still seen fit to reduce their network costs by constructing their own intercity systems, as observed in the field report shown in Section 2.4.

The figure of $193,000.00 per month referred to previously covers simultaneous two way circuits into all points. Since some stations are not likely points of origination, this figure might be somewhat reduced.

Furthermore, the high dependability which AT&T service provides does not require that duplicate circuits be provided as they are in the case of the private network under study. Therefore, the full burden for double cost in the AT&T estimate must be charged against multi-point origination and the flexibility of the two way service for shuttling of programs on an interstation basis, rather than against dependability.

It would appear that even if a single circuit system were involved, as in the case of the 1952 estimate, the cost of securing services through existing carrier facilities would far exceed those estimated for an independently constructed system.

8.3 Compressed Bandwidth Transmission Systems.

It is our understanding that research and experimentation is being carried on by the B.B.C. and other organizations along lines which permit the compression of bandwidth for video transmission at the expense of total transmission time. Reportedly, short segments of picture material have been transmitted through "low fidelity" trans-oceanic cable circuits with success. It is possible that this form of sophistication in the application of information theory may eventually permit practical transmission of program material through ordinary telephone quality circuits. It is too early to tell what these developments will provide; however, they should be watched concurrently with research on microwave networking so their full potential will not be missed.

Another form of bandwidth reduction has been demonstrated by an apparatus based on the digital encoding of television signals. Technicolor Corporation has, for instance, experimental apparatus in operation permitting anywhere from a 2 to 1 to a 4 to 1 reduction in bandwidth based on these and other sophisticated principles. (See Society of Motion Picture and Television Engineers Journal--Aug. 1959).

Research on television systems suitable for deep-Space probes is also spearheading the development of transmission systems which drastically improve the factors of picture quality and reliability-versus-bandwidth and transmitting power requirements. (See Electronic News--November 2, 1959--Page 5).

Most any of these contemporary systems might enhance the possibilities for improved transmission of television through restricted bandwidth cable circuits. On the other hand, considering the vast forthcoming needs for television program interchange in education, such an approach might be inadequate even for the immediate needs.

Since the methods used for compressing information into less bandwidth can be applied equally well to microwave transmission as well as to the recording and broadcasting field, it might be well to look upon these improvements as much needed reserves.

If, for instance, a microwave system such as that contemplated in this report were to be built to serve present needs, any equipment for bandwidth reduction could be considered as accessory items when and if such apparatus becomes available on the market. It would appear therefore, that any revolutionary developments in information transmission might best be looked on as quality improvements and necessary resources for the future rather than as alternative to current systems of microwave transmission and tape syndication. These might multiply immensely the number of circuits available through an existing microwave facility, to say nothing of picture quality advantages for both monochrome and color.

ADDENDA

RESOLUTION PASSED BY REGION IV, NATIONAL ASSOCIATION OF EDUCATIONAL BROADCASTERS AT REGIONAL CONVENTION, JANUARY 15, 1959, MINNEAPOLIS, MINNESOTA

"Representatives of Region IV of the National Association of Educational Broadcasters, meeting in Minneapolis, Minnesota, January 15, 1959, recognizing the desirability of a regional educational television network for the furthering of education at all levels in an area where the population is fairly widely scattered .... do hereby direct John Schwarzwalder, Director of Region IV, to prepare and submit an application to the Louis W. and Maud Hill Family Foundation for a grant to support a research project to investigate the feasibility of such a regional network."

APPLICATION TO THE LOUIS W. AND MAUD HILL FAMILY FOUNDATION BY THE NATIONAL ASSOCIATION OF EDUCATIONAL BROADCASTERS FOR A GRANT TO SUPPORT A PROJECT DESIGNED TO FURTHER THE EVENTUAL ESTABLISHMENT OF A REGIONAL EDUCATIONAL TELEVISION NETWORK

I. Project Title: A Study of the Steps Necessary to Establish a Regional Educational Television Network.

II. The Problem: In the states of Wisconsin, Minnesota, Iowa, North Dakota, South Dakota and Nebraska, though their area is not so densely populated as that of some other states, five television stations devoted to education now operate. These are: KTCA-TV (Minneapolis-St. Paul), KUON-TV (Lincoln, Nebraska), WHA-TV (Madison, Wisconsin), WMVS-TV (Milwaukee, Wisconsin), and WOI-TV (Ames, Iowa). The first four of these stations operate on channels reserved for education; the fifth, owned by Iowa State College, operates on a commercial channel, but pioneered in educational broadcasting. All of these stations are broadcasting live educational programs but none is inter-connected by microwave transmission to any of the others. There are additional VHF channels reserved for education at Duluth, Minnesota; Minot and Grand Forks, North Dakota; Brookings and Vermillion, South Dakota; and Des Moines and Iowa City, Iowa. There is also a very strong possibility that an additional VHF channel will be reserved in the area of Appleton, Minnesota, which is located some two hundred miles due West of Saint Paul. In addition, there are eighteen unused, reserved UHF channels in the six states.

It is obvious that microwave interconnection of not only the existing channels but also of those VHF channels which will be built in the future with grants from government at the state and national levels (and, possibly, from private sources) is highly desirable. Such interconnection would have the following educational results:

a. The provision, by television, of first-class basic educational programs, at both the in-school and adult levels, to areas presently without opportunity to receive such programs.

b. The provision, by television, to the entire area, of the contributions of great teachers now available in only a few educational centers.

c. The economy of network operation. The five stations now operating separately, but producing about 120 hours per week of educational programs could double, triple or quadruple their program services if they could use each other's best programs, particularly in content areas in which others have less distinguished or less adequate personnel or other advantages. Such an expansion of program schedules would become possible at only a fraction of the cost of producing an equivalent number of programs in their own studios (if that were possible at all, regardless of expense).

d. The resources of six states and of a large number of stations could be combined to give better quality programs.

e. Regional instead of merely parochial programs would become possible.

f. A pattern for a national educational network might be developed which would be of great value to the nation educationally. At the very least, the pattern would be very useful for other regional networks in other areas.

g. The existence of a network would in itself provide a strong stimulus for the establishment of additional educational television stations.

h. Because of the likelihood of the possible duplicate uses of such microwave qualities (as would be established to implement such a network) for educational radio stations (particularly FM) as well, a new type of educational use and integration of both television and radio would be suggested.

If these and other desirable results might accrue from the establishment of a regional network, why is such a network not already established? The answer lies in the facts that:

a. No one knows what the program resources of the area are (or might be if more stations were established).

b. No one knows what pattern the engineering (including routing) of the network should follow.

c. No one knows what the cost of the establishment of such a network would be.

d. No one knows what the cost of the operation of such a network might be.

e. No sustained consideration, on the basis of careful investigation, has been given to an administrative and policy structure under which such a network might operate.

It appears reasonable that few legislatures, private foundations or state departments of instruction are likely to recommend establishment of a regional network or expenditure of funds on any part of such a network until answers to these problems are provided. Such answers can be given only on the basis of a thorough study of the steps which must be taken to establish a regional network.

III. Objectives: The principal objective of this study would be to provide to the governors, state officers, legislators and educational administrators (including state and private college regents and trustees) of each of the six states, the following information:

a. A practical engineering plan for the establishment of the regional network, with a schedule of costs for each state's participation in the network. (Alternate routes and costs must be clearly indicated. The uses of video tape in connection with such a network must be investigated and included.)

b. A listing of program resources presently (and potentially) available to the network in order that no legislator or administrator might be in doubt as to what his constituents might receive from such a network.

c. A schedule of costs for the establishment of a network, including alternate routes and stations, state by state.

d. A schedule of costs for the operation of the network, including alternate routes and stations, also by states.

e. An administrative and policy plan for the network which would represent an informed consensus on these matters.

f. A suggested plan of use of such facilities for educational radio stations in the same area as well. (The sound portion of certain significant special programs, such as addresses and lectures, being only slightly less effective by radio than by television.)

A secondary objective of the study would be to prepare a plan which would stimulate formation of other regional networks and, eventually, both national educational television and radio networks.

In furtherance of these objectives Region IV of the National Association of Educational Broadcasters, including representatives of the states mentioned above, and with the participation of Mr. William G. Harley, President of the National Association of Educational Broadcasters and Dr. Harry J. Skornia, Executive Director, unanimously passed the following resolution supporting this project:

RESOLUTION PASSED BY REGION IV, NATIONAL ASSOCIATION OF EDUCATIONAL BROADCASTERS AT REGIONAL CONVENTION, JANUARY 15, 1959, MINNEAPOLIS, MINNESOTA

"Representatives of Region IV of the National Association of Educational Broadcasters, meeting in Minneapolis, Minnesota, January 15, 1959, recognizing the desirability of a regional educational television network for the furthering of education at all levels in an area where the population is fairly widely scattered.........do hereby direct John Schwarzwalder, Director of Region IV, to prepare and submit an application to the Louis W. and Maud Hill Family Foundation for a grant to support a research project to investigate the feasibility of such a regional network."

IV. Other Related Research:

a. State Networks and State Network Plans:

A state network exists in Alabama. One was planned for Oklahoma, though little has been accomplished on this. Florida is actively planning a state network and Ohio has formulated an excellent state network plan. All of these have some relevance to this study but, since all are confined to one state, they are of only moderate value to those planning an interstate network, with the many credit, curriculum and other problems requiring solution when programs are used across state lines. In programming, administration and policy formulation, no state network can provide guidance to a regional network on which many states must agree and in which both public and private (non-profit) institutions are involved.

b. Southern Regional Education Board Educational Television Proposals

The Southern Regional Education Board has proposed, for activation in the future, a regional network of some fourteen southern states. Its proposals differ from the present proposals in the following highly important respects:

1. The Southern Regional Education Board is a quasi-governmental organization unique in this country. The network proposed would be operated by this already existing board, created for other purposes. Its proposals have little relevance to regional planning where no such organization exists.

2. Educational television is only one aspect of the activities of the Southern Regional Education Board. It cannot devote its full energies to educational television nor does it propose to do so.

3. Many states represented in the Southern Regional Education Board have no educational television stations and comtemplate none at this time. Because of this and because of the political necessity of including all states in the plan, the Southern Regional Education Board plan calls for the inclusion of "production centers" and closed-circuit television facilities within the network.

4. The Board's plan, therefore, is essentially a "closed-circuit" plan. This, again, differs greatly from the present proposal which confines itself solely to a network of television and radio stations, and actual broadcast interchange.

c. The National Educational Television and Radio Center, whose kinescope and film network is referred to as NET (National Educational Television) currently distributes programs to the educational television stations of the United States. However, it has no present plans for a live network or the type of interchange envisioned here.

V. Procedure:

a. General Method: If, as we assume, encouragement of experimentation in better use of educational television is highly desirable, then procedures should be followed in this project which will provide a basis for greater use of educational television by more people. The procedure proposed falls under the following divisions:

1. Engineering Survey:

A survey by competent professional engineers to determine experimentally the route or routes for a network to follow for the most economical results in terms of potential audience and potential program resources. This will include a thorough field survey and utilization of the best available knowledge concerning use of existing and potential cable, microwave and video tape facilities.

2. Program Survey:

A survey by competent professional personnel in educational television to determine the educational television program resources of the area, and a thorough study of areas of strength, weakness and duplication.

3. Policy and Administration Survey, Including Finances:

A survey by competent professional personnel in educational television to determine what policies would be acceptable to those in charge of, or likely to be in charge of, the educational television effort in each state, which would also be acceptable from a practical operating point of view. The costs of the creation of such a network, including equipment, the cost of the new stations to be established, and the operating costs of both, must be determined and broken down by states.

4. Coordination of information produced by the above into a Regional Educational Television Network Plan.

This can be done only after the three surveys listed are completed. It will require the assistance of consultants in education, government and television, who have promised their full support.

b. Approximate Time Schedule:

July 1 -- October 1, 1959	Engineering Field Survey
July 1 -- October 1, 1959	Programming Field Survey
October 1 -- December 1, 1959	Policy and Administrative Survey
December 1 -- February 1, 1960	Coordination and Formation of Network Plan
February 1, 1960 -- March 1, 1960	Publication of Surveys and Network Plan

c. Expected End Product: A usable plan for an educational television network which will inform each state officer, legislator and educational administrator in the six states as to what his state must do to establish such a facility, what the cost will be and what he can expect his constituents to receive if such a network is activated. This plan will be in the form of a printed report. The report will also be available to others and, it is to be hoped, will stimulate creation of other regional networks.

d. Publication Plans: A printed report of some 1,800 copies will be made available to those mentioned above. Publication in educational journals and trade journals of various parts of the report may also be expected. National and international distribution through the National Association of Educational Broadcasters and other organizations with which it is affiliated is assured.

VI. Personnel: As Chief Consultant we propose Dr. John C. Schwarzwalder. Dr. Schwarzwalder was founder and first Manager of KUHT in Houston, the nation's first non-commercial educational television station. He is now General Manager of KTCA-TV in Minneapolis-Saint Paul, which he also established. He is uniquely familiar with both institutionally owned-and community ETV stations. He will be able to obtain leave of absence from his work to conduct the project. He is in his third term as a Director of the National Association for Better Radio and Television and his second as a Director of the National Association of Educational Broadcasters. The most recent of his numerous articles, "The Promise of Teaching by Educational Television," appears in the current issue of College English. He would be able to bring to the project the cooperation of a successful, operating and respected ETV station in the area concerned.

As Engineering Consultant we propose Mr. Berten Holmberg, Video Tape Product Control Engineer, Minnesota Mining and Manufacturing Company. Mr. Holmberg, who can obtain leave of absence for the project, is a graduate engineer with eighteen years of broadcast experience. He has served as Chief Engineer for KTCA-TV and prior to that he was Chief Engineer for KUOM, the University of Minnesota radio station. He has been a member of the National Association of Educational Broadcasters Engineering Committee for eight years.

As Programming Consultant we propose Mr. Paul Owen, Assistant Manager of KTCA-TV and former Assistant Manager and Manager of KUHT. Mr. Owen is widely experienced in commercial broadcasting and is a pioneer in educational television. Leave for him can also be arranged, though this would not necessarily be at the same time as Dr. Schwarzwalder's leave.

VII. Facilities: The office and fiscal facilities of KTCA-TV and NAEB are available to support the project without cost. A fully equipped engineering truck is available for the engineering survey.

VIII. Duration: Total amount of time required: Eight months, including preparation of report.

A Map showing potential additional coverage using translators is being prepared. However, at any relay station, coverage to at least a fifteen mile radius can be assumed by means of translator broadcasting.